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CTX 5000 Screener Training for the FAA's Airport Demonstration Project

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16. Abstract This document contains an edited version of the syllabus used to train airport screeners on how to operate and resolve alarms on the CTX 5000 Explosives Detection System. The training took place within the context of the Airport Demonstration Project, currently on-going at 3 airports: San Francisco, Atlanta, and Manila, Philippines. The actual syllabus used to train screeners at the demonstration sites differed in site-specific ways from the edited version presented here. The objectives of the training course were to provide screeners with the necessary skills and knowledge to competently operate the CTX 5000. This syllabus describes all aspects of the training curriculum, including screener performance objectives, materials and equipment required for the course, the structure of lesson and final evaluations, and the classroom training agenda.			
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PREFACE

This document provides a description of the training syllabus used to give initial training for CTX 5000 operators. The training syllabus was developed by Lawrence Livermore National Laboratories in conjunction with the FAA Aviation Security Human Factors Program and InVision Technologies in order to provide a systematic and sound training program to support the FAA Airport Demonstration Project evaluation of the CTX 5000 system. In addition, the syllabus provides a basis for assessment of trainees' mastery of the material through a series of knowledge-based and performance testing. The key FAA personnel who supported this training development and testing effort are J. L. Fobes, Ph.D., Aviation Security Human Factors (AvSec HF) Program Manager and Stephen Cormier, Ph.D., Engineering Research Psychologist for the Aviation Security Research and Development Division respectively.

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List of Acronyms and Abbreviations

CT	Computed Tomography
EDS	Explosives Detection System
FAA	Federal Aviation Administration
IED	Improved Explosive Device
LEO	Law Enforcement Officer
MBS	Modular Bomb Set
OJT	On-the-Job Training
Q&A	Question and Answer
R&D	Research and Development
RDS	Remote Display System
SFO	San Francisco International Airport

Section 1: Course Description

This section describes all aspects of the training curriculum, including screener performance objectives, materials and equipment required for the course, the structure of lesson and final evaluations, and the classroom training agenda.

Course Outline

The training syllabus consists of the following five sections:

Section 1: Course Description

- Objectives
- Training Materials and Equipment
- Class Size
- Classroom Training Agenda
- Structure of Lesson Plans
- Evaluations

Section 2: Classroom Training

- Lesson 1: Introduction
- Lesson 2: Background
- Lesson 3: General Overview of the CTX 5000
- Lesson 4: X-ray Screen
- Lesson 5: CT Screen
- Lesson 6: Console Panel and Scanner
- Lesson 7: Explosives and Components
- Lesson 8: CT and X-ray Images of Explosives and Non-Explosives
- Lesson 9: Threat Resolution Protocol and Decision Criteria
- Lesson 10: Protocol for Handling Potential Threat Objects
- Lesson 11: Review of CTX 5000 Operational Procedures
- Final Classroom Training Evaluation

Section 3: Hands-On Operations

- Classroom Training Performance Evaluation

Section 4: Screener Performance Evaluation Procedures

Section 5: On-the-Job Training (OJT)

Objectives

The objectives of the training course are to provide screeners with the necessary skills, knowledge, ability, and conceptual and operational understanding to competently operate the CTX 5000.

These objectives will be achieved by providing an instructional approach that is *skill-*, *rule-*, and *knowledge-based*. Upon completion of the training course, screeners should:

1. Understand the purpose, function, and operation of the CTX 5000.
2. Understand their roles, duties, and responsibilities as CTX 5000 operators.
3. Gain basic knowledge and comprehension of military, commercial, and improvised explosives, including improvised explosive device (IED) components and configurations.
4. Be able to identify and recognize explosives, IED components, non-explosive threats, and common and frequently seen objects on both the CT and X-ray screens.
5. Develop proficient decision-making skills in determining the level of threat-uncertainty that requires either further inspection of CT or X-ray images, a physical search of the bag, or notification of the CTX supervisor or security law enforcement officer (LEO).
6. Know and understand the appropriate procedures to take when confronted with a potential threat.
7. Develop the necessary skills to proficiently, independently, and confidently operate the CTX 5000, utilizing all threat resolution tools.

Training Materials and Equipment

1. Training syllabus for trainers.
2. Screener handout package.
 - a) Classroom training agenda
 - b) Glossary of acronyms
 - c) Terms and definitions
 - d) Summaries for each lesson plan
 - e) Threat resolution flowchart

3. InVision Users Manuals for screeners.
4. Notepads and pens for screeners.
5. InVision CTX 5000 video.
6. Whiteboard, blackboard, or flip chart.
7. InVision's CTX 5000 simulation program (showing slicing process) video.
8. FAA video of aircraft bombing accidents, e.g., Lockerbie, Scotland, 1988; Athens, Greece, 1986; Ireland, Air India, 1985.
9. Inert explosive simulants.
10. Modular Bomb Set (MBS) containing inert simulated explosives and IED components.
11. Other IED components.
 - a) non-electric blasting cap
 - b) micro-detonator
 - c) pipe bomb container
 - d) electric shave power chord
 - e) watch batteries
 - f) 555
 - g) E-Cell
 - h) Other digital timers
 - i) Mechanical timer
 - j) Barometric
 - k) wires of various lengths and types
12. Demonstration objects that have been sliced at various angles, including the following items:
 - a) electronic items (i.e., radios, computers, walkman radio, cellular phones)
 - b) books and magazines
 - c) plates, cups, and saucers
 - d) shoes
 - e) canned foods
 - f) apple

- g) bottles (with various liquid densities)
 - h) wine bottle
 - i) blow dryer
 - j) iron
 - k) video cassettes, CDs, and tapes
 - l) golf clubs and balls
13. A total of 100 slides, overheads, or computerized paired, colored, CT and X-ray images (50 for each) from the CTX 5000. For each CT image there should be a corresponding X-ray image of the same baggage in order to allow screeners to compare images from the two screens.

The 100 images will consist of the following:

50 *threat* images (25 CT; 25 X-ray)

50 *non-threat* images (25 CT; 25 X-ray)

Fifty images of baggage containing threat objects should include the following:

- a) All explosive types and components in various combinations
- b) Explosives in a radio
- c) Explosives in a book
- d) Explosives as part of a bag

Additionally, the following four bomb groups should be represented in these samples:

- a) Open devices - no artful concealment; just in container.
- b) Closed (contained) devices - artful concealment, e.g., electronic items.
- c) Sympathetic (detonation) devices - power supply, switch, and detonator in concealment; bulk charge in close proximity (may or may not be concealed).
- d) Suitcase devices - components concealed in the baggage; bag is a bomb.

Fifty images of baggage containing non-threat objects should include the following:

- a) electronic items (i.e., radio, computer, walkman radio, cellular phone)
- b) books and magazines
- c) (stacked) plates, cups, and saucers
- d) clothes
- e) shoes
- f) canned foods

- g) candies
 - h) box of apples
 - i) bottles (with various liquid densities)
 - j) wine bottles
 - k) blow dryers
 - l) toiletries
 - m) irons
 - n) video cassettes, CDs, and tapes
 - o) golf clubs and balls
14. Colored slides, overheads, or computerized pictures of the CT screen (without image) (Figures 6, 8, 13, 15; from InVision Users Manual, version 6.1.10).
 15. Colored slides, overheads, or computerized pictures of the X-ray screen (without image) (Figures 6, 7, 12, 14, 15; from InVision Users Manual, version 6.1.10).
 16. Colored slides, overheads, or computerized picture of the console panel (figure 5; from InVision Users Manual, version 6.1.10).
 17. Colored slides, overheads, or computerized pictures of the CTX 5000 workstation (Figures 1a, 1b, and 2; from InVision Users Manual, version 6.1.10).
 18. TV and VCR.
 19. Slide projector or overhead projector and screen.
 20. Lesson evaluations.
 21. Comprehensive final evaluations.
 22. Evaluation score sheet and Summary of scores.
 23. Post-training screener survey forms.
 24. Fifty packed baggage samples - [Refer to CT and X-ray image list (number 10 above) for a list of objects to be used in packed bags].
 Twenty-five baggage samples containing threat objects. These objects should be repeatedly shown in as many angle variations as possible.
 Additionally, the following four bomb groups should be represented in these samples:
 - a) Open devices - no artful concealment; just in container.
 - b) Closed (contained) devices - artful concealment, e.g., electronic items.

- c) Sympathetic (detonation) devices - power supply, switch, and detonator in a concealment; bulk charge in close proximity (may or may not be concealed).
- d) Suitcase devices - components concealed in the baggage; bag is a bomb.

Twenty-five baggage samples containing no threat objects (with commonly seen objects) - these objects should be repeatedly shown in as many angle variations as possible.

25. Calibrated CTX 5000 system.

Class Size

The number of screeners participating in the classroom and hands-on operational training should not exceed six screeners. It is important to keep the group small so that screeners receive individual attention from the instructor.

Evaluations

Individual lesson evaluations will be given immediately after each lesson plan, and a comprehensive final evaluation will be given upon completion of all lesson plans. The evaluations will serve: (1) as a diagnostic tool to reflect instructional errors and missed items, (2) as a diagnostic tool to reflect screener errors and level of knowledge acquired, and (3) as an indicator of when the instructor may advance to the next lesson plan. Lesson evaluations should be scored immediately, before proceeding to the next lesson.

The final evaluation will contain questions that have already been presented in the individual lesson plans. Screeners should be told this in advance so that they will be better prepared for the final evaluation.

Lesson evaluations - The individual lesson evaluations will be a brief written evaluation given after each lesson plan. When screeners have completed the evaluation, the trainer should review all questions and answers and clarify any misunderstandings or confusion the screeners may have. Prior to each lesson evaluation, the trainer should remind screeners that the final evaluation will consist of questions from the individual lesson evaluations. Individual lesson evaluations will be collected but not used for completion standard requirements. Screeners will have thirty minutes to complete each lesson evaluation.

Final comprehensive evaluation - The final evaluation is comprehensive and will include material covered in all lesson plans, including operational knowledge and skills, knowledge of explosives, identification of both threat and non-threat objects, screener roles and responsibilities, and conceptual understanding of the CTX 5000. The final evaluation will include both written and demonstration questions. Demonstration questions involve the trainer showing and asking screeners to identify components, functions, displays, and CT images on the CTX 5000. The final evaluation will be

collected for evaluation of screener competency based on completion standard criteria for the CTX 5000. This evaluation should take approximately one hour to complete.

It is recommended that screeners score at least 80% on the individual lesson evaluations and 90% on the final comprehensive evaluation. Scoring should be done immediately after each lesson evaluation to determine if screeners are ready to proceed to the next lesson plan.

Classroom Training Agenda

Classroom Training Day 1: Lessons 1–4

Day 1	Lesson	Instructor
8:30–9:00	Lesson 1: Introduction	
9:00–9:30	Lesson 2: Background	
9:30–10:00	Lessons 1 & 2 Evaluation	
10:00–10:15	BREAK	
10:15–12:15	Lesson 3: General Overview of the CTX 5000	
12:15–1:00	LUNCH	
1:00–1:30	Lesson 3 Evaluation	
1:30–2:30	Lesson 4: X-ray Screen	
2:30–2:45	BREAK	
2:45–3:45	Lesson 4: X-ray Screen (cont'd)	
3:45–4:15	Lesson 4 Evaluation	
4:15–4:45	Review lessons 1–4	

Classroom Training Day 2: Lessons 5-7

Day 2	Lesson	Instructor
8:30-10:00	Lesson 5: CT Screen	
10:00-10:15	BREAK	
10:15-11:15	Lesson 5: CT Screen (cont'd)	
11:15-11:45	Lesson 5 Evaluation	
11:45-12:30	LUNCH	
12:30-2:00	Lesson 6: Console Panel	
2:00-2:15	BREAK	
2:15-2:45	Lesson 6 Evaluation	
2:45-3:45	Lesson 7: Explosives and Components	
3:45-4:00	BREAK	
4:00-4:30	Lesson 7: Explosives and Components (cont'd)	
4:30-5:00	Lesson 7 Evaluation	
5:00-5:30	Review lessons 5-7	

Classroom Training Day 3: Lessons 8-10

Day 3	Lesson	Instructor
8:30-10:00	Lesson 8: Non-Explosive CT & X-ray Images	
10:00-10:15	BREAK	
10:15-11:15	Lesson 8: Non-Explosive CT and X-ray Images (cont'd)	
11:15-11:45	Lesson 8 Evaluation	
11:45-12:30	LUNCH	
12:30-2:30	Lesson 9: Threat Resolution Protocol and Decision Criteria & Explosive Images	
2:30-2:45	BREAK	
2:45-4:15	Lesson 9: Threat Resolution Protocol and Decision Criteria & Explosive Images (cont'd)	
4:15-4:30	Lesson 9 Evaluation	
4:30-5:00	Review lessons 8-9	

Classroom Training Day 4: Lessons 10-11 and Final Evaluation

Day 4	Lesson	Instructor
8:30-10:00	Lesson 10: Protocol for Handling Potential Threats	
10:00-10:15	BREAK	
10:15-11:45	Lesson 11: Review CTX 5000 Operational Procedures	
11:45-12:30	LUNCH	
12:30-1:30	Lesson 11: Review CTX 5000 Operational Procedures (cont'd)	
1:30-1:45	BREAK	
1:45-2:15	Lesson 11 Evaluation	
2:15-3:15	Review lessons 1-11	
3:15-3:30	BREAK	
3:30-4:30	Comprehensive Final Evaluation	

Classroom Training Day 5: Hands-On Operations

Day 5	Lesson	Instructor
8:30–10:00	Hands-On Operations	
10:00–10:15	BREAK	
10:15–12:15	Hands-On Operations	
12:15–1:00	LUNCH	
1:00–2:30	Hands-On Operations	
2:30–2:45	BREAK	
2:45–4:45	Hands-On Operations	

Structure of Lesson Plans

A *skill-, rule-, and knowledge-based* approach was used in the development of the lesson plans to facilitate both cognitive (i.e., decision-making, memory) and physical (manual) skills in the screener. The structure of the lesson plans was based on the following theories and principals:

Building block principal - Each of these sections has been decomposed into subsections which represent individual units, or blocks of learning and should be viewed as separate lessons in themselves. Each lesson, or block, is an integral part of the total instructional system design and should be fully completed and understood by screeners before continuing on to the next lesson. This linear programming approach allows screeners to proceed through each successive instructional block, as they progressively reach the final training objectives.

Meaningful repetition - It is extremely important that screeners retain information that they receive in training. To aid screeners in learning and retaining knowledge, information is repeated throughout the lessons.

Tell and do method - This method involves the participation of both the instructor and the screeners. The instructor relays information to the screeners by first explaining the material and then following up with a physical demonstration of what was discussed. Screeners are also involved in the tell and do process. In various lessons, screeners will be required to perform hands-on procedural tasks while verbally describing what they are doing. This allows the screeners to think about what they are doing and the instructor to understand the thought processes of the screeners.

Instructional aids - When information is presented in more than one form, screeners are able to auditorily, visually, and tactually process information, facilitating the learning process. Many instructional aids will be used throughout the training course, including handouts, slides, computerized images and animation, and physical demonstration objects.

Motivation - Throughout the training course, instructors should keep screeners motivated by the learning process. Instructors can do this by encouraging screeners to be involved in discussions and participation, showing interest in screeners' opinions, giving positive feedback when screeners are performing well, clearly defining lesson objectives and explaining how these newly acquired skills can be significant to their job, and using interesting and creative instructional aids.

Each lesson plan contains an *objective, lesson time, training materials and equipment, content, summary, key terms, and a completion standards*. The completion standards criteria will be measured by a comprehensive final evaluation, given at the end of the training course, which will include material covered in lessons one through eleven. The purpose of the final evaluation is to quantitatively and qualitatively measure screeners' abilities and knowledge of the facts, concepts, procedures, and rules necessary to operate

the CTX 5000 and to provide feedback to enhance screener performance.

Section 2: Classroom Training

The classroom training section consists of eleven lesson plans. When each lesson plan has been completed, screeners will be required to take the individual lesson evaluation. The instructor should not continue to the next lesson plan until all screeners demonstrate sufficient understanding and knowledge of the information presented in the previous lesson.

To ensure that screeners fully understand lesson contents, it is extremely important that instructors continually ask questions of the screeners, encourage screeners to ask questions, and be repetitive in giving information, throughout the training course.

Lesson 1: Introduction

Objective	Give screeners a <i>general overview</i> of the training course, their roles and responsibilities in operating the CTX 5000, and screener performance objectives.
Lesson Time	Approximately 30 minutes
Training Materials & Equipment	1. Screener handout packages 2. InVision Users Manuals for screeners 3. Notepads and pens for screeners

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

Lesson one describes the training course, screener participation in the training program, and the CTX 5000 system.

1. Introductions.
2. Ground Rules and Information (i.e., restrooms, questions).
3. Read and discuss the lesson objective.
 - a) Participation in the project
 - b) CTX 5000 system
 - c) Structure of training course
 - d) Screener performance objectives
4. Participation in the project.

- a) Why are you here? You are here to learn to operate a new explosive detection system (EDS) that detects and alerts screeners when there are materials that the system “thinks” are explosives.
 - b) You will be part of a team that will be using this new system .
- 5. CTX 5000 system.
 - a) The system is called “CTX 5000,” developed by InVision Technologies of Foster City, California.
- 6. Structure of training course (hand out “Course Outline” and “Classroom Training Agenda”).
 - a) Describe “Course Outline” (page 2–3)
 - Go over each of the sections and subsections (lesson plans)
 - b) Describe “Classroom Training Agenda” (page 7–8)
 - Describe class structure and participation
 - Informal atmosphere
 - Would like you to participate and speak up
 - Encourage screeners to ask questions if they don’t understand something
 - c) Describe lesson and final evaluation(s). You will be given a thirty-minute evaluation following each of the lesson plans. At the end of the training session, you will be given a comprehensive final evaluation. Make sure you pay attention to the questions on the lesson evaluations because the same questions will be on the final evaluation.
- 7. Describe screener performance objectives (from Section 1, “Course Description — Objectives”) and explain that by the end of the training course, screeners should:
 - a) Conceptually and operationally understand the purpose and functions of the CTX 5000.
 - b) Understand their roles, duties, and responsibilities as CTX 5000 operators.
 - c) Have basic knowledge and comprehension of military and commercial explosives, including improvised explosive device (IED) components and configurations.
 - d) Be able to identify and recognize explosives, IED components, non-explosive threats, and common and frequently seen objects on both the CT and X-ray screens.
 - e) Have proficient decision-making skills in determining the level of threat-uncertainty that requires either further inspection of CT or X-ray images, a physical search of the bag, or notification of the CTX supervisor or security law enforcement officer (LEO).

- f) Have knowledge and understanding of appropriate procedures to take when confronted with a potential threat.
 - g) Have the necessary skills to proficiently, independently, and confidently operate the CTX 5000, utilizing all threat resolution tools.
9. Question and answer (Q&A) period.

Key Terms

CTX 5000

EDS (Explosive Detection System)

FAA (Federal Aviation Administration)

InVision Technologies

Completion Standards

The lesson will have been successfully completed when, as shown by a lesson evaluation, screeners have a clear and thorough understanding of the following:

- a) The purpose of their participation
- b) Their *role*
- c) Their *responsibilities*
- d) Performance objectives during normal operational use and the training course
- e) The CTX 5000

Lesson 2: Background

Objective	Give screeners an understanding of the changing trends in airport security (both threats and technologies) and how these issues relate to InVision Technologies, the CTX 5000, and screener participation in the airport demonstration project.
Lesson Time	Approximately 30 minutes
Training Materials & Equipment	<ol style="list-style-type: none">1. TV and VCR2. InVision CTX 5000 video3. FAA video of airline bombing accidents4. Slide projector or overhead projector and screen5. Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

1. Read and discuss the lesson objective.
 - a) Airport security background
 - b) InVision and CTX 5000
 - c) Airport demonstration project
 - d) How do screeners fit into the airport demonstration project?
2. Airport Security Background.
 - a) The threats in aviation have changed over the years. In the 1960s and '70s, the primary concern was hijacking. In more recent years, especially since the 1989 Pan Am flight 103 bombing in Lockerbie, Scotland, concern over aircraft sabotage has replaced the fear of hijacking— specifically, bombings at altitude.
 - b) Show video of airline bombing accidents.
 - c) There is now a need for more sophisticated technology to detect these new threats. In the past, standard metal detectors and X-ray machines were sufficient for screeners to detect firearms. Since terrorists began using plastic explosives, however, detection has become much more difficult. The conventional metal detectors and X-ray machines that you are currently using are no longer adequate. New technologies are currently being developed and tested to detect the current threat of explosives.

- d) The Federal Aviation Administration's (FAA) primary goal is to ensure the protection and safety of passengers. The agency is actively involved in the research and development of explosive-detection systems. The CTX 5000, the system about which you will be learning today, is one EDS.
3. InVision and CTX 5000.
- a) Discuss certification of CTX 5000. The CTX 5000 is the first and only EDS certified by the FAA. Certification means that the performance of the CTX 5000 has met certain requirements as specified by the FAA, but it will require further testing and evaluation over the next year.
 - b) Show "InVision CTX 5000" video.
 - c) The CTX 5000 is currently operating in several countries outside the U.S. (e.g. airports at Manchester, London, Tel Aviv, Brussels).
4. Airport demonstration project.
- a) FAA and airlines will be testing and evaluating the CTX 5000 over the next year.
 - b) Logistics: Including use for checked baggage, 1 year project, hours of operation.
5. How do screeners fit into the airport demonstration project?
- a) Why are you here? You are here to learn to use the CTX 5000. This is a new system that is completely different from what you are used to. It detects materials that might be explosives and alerts screeners. After the system has alarmed, you must determine if the object identified as an explosive by the machine is (a) a real explosive, (b) part of an explosive device, or (c) a false alarm (a non-explosive object that the machine thought was an explosive). Images on the CT screen will look VERY DIFFERENT from conventional X-ray images.
 - b) EMPHASIZE importance of screener involvement.
 - The CTX 5000 is the first and only certified EDS in the U.S.
 - You are among the first screeners in the U.S. to use the CTX 5000. You should consider yourselves to be "pioneers". You should also look at this training as a special opportunity to acquire skills using this new technology.
 - This is the only time that you, as screeners, will be allowed to make mistakes. There will be no retribution or fines for errors! You are all part of the test team.
 - Expect a lot of questions — people will be interested in the system. Your opinions are *very* important and will help us in designing future systems. It is very important that you voice your opinions or concerns about the CTX 5000. If you notice something that you think needs to be changed, either tell your CTX supervisor or write it down on a notepad to give to your CTX supervisor later.

6. Q&A period.

NOTE: Evaluations for Lesson 1 and 2 will be combined and given at the end of Lesson 2.

Summary

In summary, I'd like to review some of the key points that were discussed in lessons 1 and 2. Please pay careful attention because the following items will be in your lesson evaluation.

1. The reasons that you are here is to learn how to use the CTX 5000, to learn about the airport demonstration, to understand the importance of learning to use an explosive detection system, to understand your role as screeners using the CTX 5000.
2. The CTX 5000 detects objects that it thinks are explosives and then alerts the screener. In other words, it looks for objects that are composed of materials similar to those found in explosives. Although it is capable of detecting explosives, it will frequently alarm on non-threat objects that it thinks are explosives. It is your job to determine if the object is a real threat or a false alarm. Therefore, it is very important that you learn to determine actual threat objects from non-threat objects.
3. The CTX 5000 is an EDS, or explosives detection system. It is different from other X-ray machines that you have used because X-ray machines do not automatically detect explosives. The CTX 5000 will alert you when it thinks it has found an explosive.
4. Threats have changed over the years. Years ago, hijackings were our primary concern and our job as screeners was to look for weapons such as handguns and grenades. Terrorists these days are much more sophisticated and more frequently use explosives as a means of terrorism. These explosives are very difficult to detect and easy to hide.
5. The FAA and the airlines need to evaluate and test the CTX machine to see how well it works and to determine if there are any problems with the machine. The FAA and the airlines will NOT be testing your abilities on the machine, so please don't worry about how well you perform. Just do the best that you can.
6. The airport demonstration will last one year, but the airlines may decide to continue using the CTX 5000 after the airport demonstration is over. Therefore, it is possible that you might continue using this machine even after the airport demonstration.
7. It is very important to give as much information as possible to anyone asking questions (that is an employee of the FAA, the airlines, or the security company). Your input can be very helpful, so the more information you can give on problems that you are having with the machine, the better. Also, when you have questions or come across problems using the machine, please write it down and mention it to the CTX supervisor.

Key Terms

CTX 5000 certification

Completion Standards

The lesson will have been successfully completed when, as shown by a successfully completed lesson evaluation, screeners demonstrate a fundamental understanding of current threats and how the CTX 5000 may detect these threats. Screeners should also demonstrate an understanding of the relationship between themselves, the CTX 5000, and the airport demonstration project.

Lessons 1-2 Evaluation

This evaluation is included as an example of the end-of block knowledge tests. The test items for the other lesson blocks are not included in this document in order to retain confidentiality.

To obtain a copy of the tests, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Please circle the correct response for each of the following questions or statements. Please read EACH question very carefully before responding as all answers may be correct.

1. *The main reason that you are here is:*
 - a) To learn how to use the CTX 5000
 - b) To learn about the airport demonstration
 - c) To understand the importance of learning to use an explosive detection system
 - d) To understand your role as screeners using the CTX 5000
 - e) All of the above
2. *Circle one choice that best describes what the CTX 5000 system does.*
 - a) The CTX 5000 detects explosives and is *always* correct
 - b) The CTX 5000 detects objects that it thinks are explosives but may *not* always be correct
 - c) The CTX 5000 is capable of detecting guns and other non-explosive threat objects
 - d) When the CTX 5000 alarms, the screener does NOT have to determine if the object is a real threat
 - e) None of the above
3. *Circle one choice that best describes the CTX 5000 system.*
 - a) The CTX 5000 is currently being used at many airports in the U.S.
 - b) Many screeners in the U.S. are using the CTX 5000
 - c) The CTX 5000 is the *fourth* certified explosive detection system in the U.S.
 - d) The CTX 5000 is the *first* certified explosive detection system in the U.S.
 - e) None of the above

4. *How is the CTX 5000 different from other X-ray machines that you have used in the past?*
- a) The CTX 5000 system is EXACTLY the same as other X-ray systems
 - b) The CTX 5000 detects objects that it thinks are explosives, unlike other X-ray machines which are not capable of detecting explosives
 - c) The screener never has to look at bag images when using the CTX 5000
 - d) The screener never has to determine if objects are threats, but can trust the CTX 5000 to make all decisions
 - e) All of the above

Lessons 1–2 Evaluation, continued

5. *Why is it important that we have a machine that detects explosives?*
 - a) To stop any explosive devices from getting aboard an aircraft
 - b) More terrorists are using explosives
 - c) Current X-ray machines do not detect explosives
 - d) To ensure the safety of passengers
 - e) All of the above
6. *What is the purpose of the airport demonstration?*
 - a) To enable the FAA and airlines to test and evaluate the CTX 5000 to see how well it works
 - b) To determine if there are any problems with the CTX 5000
 - c) To receive feedback from screeners on how well they like or dislike the CTX 5000
 - d) To see how well the CTX 5000 works in the U.S.
 - e) All of the above
7. *How long will the airport demonstration last?*
 - a) 2 weeks
 - b) 1 month
 - c) 6 months
 - d) 1 year
 - e) 5 years
8. *What should you do if people ask you questions about the CTX 5000?*
 - a) ALWAYS give answers to ONLY personnel who are involved in the airport demonstration project (airlines, FAA, security, supervisor)
 - b) NEVER give answers to anyone
 - c) ALWAYS give answer to ANYONE who asks — including reporters and passengers
 - d) Give information ONLY to other screeners
 - e) None of the above

<i>Lessons 1–2 Evaluation, continued</i>
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9. *What should you do if you are having problems or concerns with the CTX 5000?*
- a) Don't worry about it — the problem will probably be fixed later
 - b) Talk to another screener about the problem
 - c) Either tell your CTX supervisor or write the problem down on a notepad and give it to your CTX supervisor later
 - d) Write the problem down and mail it to InVision Technologies
 - e) Write the problem down and mail it to the airlines
10. It is important that throughout the training course, you:
- a) Ask questions when you don't understand something
 - b) Participate in classroom discussions
 - c) Give your opinions on what you like or don't like about the CTX 5000
 - d) Feel comfortable and enjoy the training course!
 - e) All of the above

— END OF EXAM —

Lesson 3: General Overview of the CTX 5000

Objective	Familiarize screeners with the capabilities of the CTX 5000 system in terms of the three primary subsystems: screens for X-ray and CT images, the console panel, and the scanner and conveyor belt system. The purpose of this lesson is to prepare screeners for subsequent hands-on operational use of the CTX 5000 by ensuring that they conceptually understand the basic components of the system. This lesson is intended to only train screeners on <i>general</i> functional operations of the system. Commonly used words, terms, and concepts will also be defined.
Lesson Time	Approximately 2 hours
Training Materials & Equipment	<ol style="list-style-type: none"> 1. Colored slides or overheads of CT screen 2. Colored slides or overheads of X-ray screen (figure 2, 7) 3. Colored slides or overheads of Console panel (figure 2, 5) 4. Slide projector or overhead projector and screen 5. InVision's CTX 5000 simulation program video 6. Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

1. Read and discuss the lesson objective.
 - a) X-ray screen
 - b) CT screen
 - c) Console panel
 - d) 2-unit scanner (X-ray unit and CP unit) and conveyor belt
 - e) Definitions of commonly used words, terms, and concepts
2. In this lesson, I will briefly describe to you some of the general components of the CTX 5000 in order to give you a very general understanding of the system. After this lesson plan, I will describe in much greater detail all of the items that I have briefly discussed in this lesson plan. So don't be concerned if you don't understand everything right now — it will become clearer to you after the next few lessons. Please ask questions though, if you are confused.
3. [Show pictures corresponding to each of the following]. The CTX 5000 consists of four main parts:
 - a) The whole unit is called the CTX 5000 workstation

- b) Two display screens: (1) X-ray screen, and (2) CT screen
- c) Console panel which has the trackball and other controls
- d) Scanner (X-ray unit and CT unit) and conveyor belt

Each of these parts will be explained in more detail.

4. Purpose of CTX 5000

- a) The CTX 5000 will automatically detect objects that it thinks are explosives. When the system thinks it has detected an explosive, the machine will alarm. This is called a ***machine alarm***.
- b) It is VERY important to remember that although the system thinks there is an explosive and has alarmed the machine, there may not be a real threat object. It is your job to examine the object and decide whether the object is a real threat or a false alarm.
- c) The screener's primary goal is to examine alarmed objects and decide whether the object is a real threat or a false alarm. This is referred to as ***threat resolution***. Threat resolution is the process of *identifying* and *recognizing* objects that appear to be threats, and making a decision to either clear the bag or hold it for further investigation.
- d) After the machine has alarmed, the screener must determine if the threat is a real threat or a false alarm. To aid screeners in identifying and recognizing objects, screeners will use ***threat resolution tool keys***. These are keys that are located on both the X-ray and CT screen, as well as on the console panel. Examples of threat resolution tools are the zoom, sharp X-ray, invert image, or more slices functions.
- e) Any keys located on the console panel or baggage control unit are called ***hard keys*** [Show picture of console panel]. These are actual, physical, and moveable keys that allow you to perform a specific function — for example, turn on the system, clear or hold baggage, and use the trackball and trackball buttons to use controls on the display.
- f) Any keys located on either the X-ray or CT screens are called ***soft keys*** [Show picture of X-ray and CT screens]. Soft keys are on-screen buttons that can only be used when selected by the trackball and trackball buttons and are used for machine operations and threat resolution tools. Some soft keys include color range, invert image, and contrast functions.
- g) ***Resolved (CLEARED) alarm*** — when the system alarms and the screener is able to determine that the bag contains a false alarm, or non-threat object, the screener has then resolved the alarm. The screener resolves the alarm by using threat resolution tools which are used to enhance images and aid screeners in decision-making.
- h) ***Unresolved (UNCLEARED) alarm*** — an unresolved alarm is when the system alarms and a screener, after using the threat resolution tools, still cannot determine

if a threat object is inside. At this point, the screener or CTX supervisor must physically search the bag to resolve the alarm.

5. **X-ray Screen** [Show Figure 2 and point to each item on the screen].
 - a) The X-ray screen on the CTX 5000 is very similar to other X-ray screens. Although the actual baggage image will look no different than other X-ray images you are used to viewing, there is additional information on the X-ray screen that is slightly different from other X-ray displays that you have seen.
 - b) The purpose of the X-ray screen is for you to examine baggage as you would any other X-ray system. You should be looking at both the X-ray and CT screens. The X-ray screen should aid you in recognizing objects that cannot be identified from just the CT screen.
 - c) All objects that the machine thinks are explosives will be bordered in color on the X-ray screen, for ease of rapid viewing.
 - d) The X-ray screen contains threat resolution tool keys which allow the screeners to help identify real threats from non-threats.
6. **CT Screen** [Show Figure 2 and point to each item on the screen]
 - a) Show InVisions's CTX 5000 simulation program video
 - b) The images seen on the CT screen are very different from the X-ray images. These images are very similar to medical CT images.
 - c) The images on the CT screen will be seen from the a different angle than images on the X-ray screen. For example, if the baggage handle is facing towards you when it enters the scanner, the handle will appear on the bottom of the CT screen.
 - d) The CT images displayed at any one time consist of a set of seven images of consecutive slices through the object. There is one large CT window and 6 smaller CT windows.
 - e) **CT Cross-sectional images** — [Show CT screen] the CTX 5000 automatically displays images taken from the CT scanner. The CT cross-sectional images consist of all the images taken at various slice planes. In this manner, all objects within that plane are displayed. Imagine slicing a loaf of bread. Each slice of bread is similar to the scanned CT slice. Just so that you really understand the process of CT scanning and cross-sectional slices, I will show you the simulation program again. [show InVision's CTX 5000 simulation program again]
 - f) All objects that the machine thinks are explosives will be highlighted and bordered on the CT screen for ease of rapid viewing. Again, I'd like to remind you that it is VERY important to remember that just because the system thinks there is an explosive, it does not mean that the object really is an explosive. It is your job to examine the object and decide whether the object is a real threat or a false alarm.

- g) The CT screen contains threat resolution tool keys which allow the screeners to help identify real threats from non-threats.

7. **Console Panel** [Show Figures 1 and 2 and point to each item on the screen].

- a) Power. The power switch has three positions: OFF, RUN, and DISABLE X-RAY.
 - The OFF switch turns the power off. The system cannot be operated in the OFF position.
- b) The RUN switch turns the system on.
 - The DISABLE X-RAY switch turns the X-ray off for safety.
- c) The console panel contains threat resolution “tool” keys which allow the screeners to help identify real threats from non-threats.
- d) Display lights are used to let you know the status of the machine. For example, the green light on the upper left corner indicates that the power is on.
- e) CLEAR key. When the alarmed object has been determined to be a false alarm, or non-threat, the CLEAR key is used.
- f) SUSPECT key. When the alarmed object has been determined to be a threat, the SUSPECT key is used.
- g) *Trackball* — [Show picture of console panel] trackballs are often seen with computers; in concept it is very similar to a mouse. If you’re not familiar with a trackball, it is a round ball on the CTX 5000 console panel which controls the cursor on the display screens, enabling screeners to point to a specific function or area on the screen and click (using the trackball buttons) to use threat-resolution tools.

8. **Scanner and Conveyor Belt** [Show Figure 1 and point to each item on the screen].

- a) The scanner consists of two units, the X-ray unit and the CT unit.
- b) The conveyor belt is used for loading baggage through the scanner and unloading to the back. It is similar to conveyor belts that you have used on other X-ray systems.
- c) Baggage modes. There are three baggage modes keys which control baggage movement (which can be used individually or in combination to produce 5 different operating modes). The machine should already be in the appropriate mode, but the screener should verify that it is in the correct mode.
 - Never Hold
 - Always Hold
 - Hold on Alarm

These three baggage keys will be discussed in greater detail later.

9. Q&A period.

Summary

In summary, I'd like to review some of the key points that were discussed in this lesson. Please pay careful attention because the following items will be in your lesson evaluation.

1. The main components of the CTX 5000 are the X-ray screen, the CT screen, the console panel, and the scanner and conveyor belt.
2. The conveyor belt is used for loading baggage through the scanner. It is similar to conveyor belts that you have used on other X-ray systems.
3. The purpose of the X-ray screen is for you to examine baggage as you would normally on any other X-ray system. Additionally, it will aid you in recognizing objects that cannot be identified by the CT screen.
4. The CT screen shows images of CT cross-sectional slices, which are objects viewed in a slice plane.
5. The CT images are viewed at different angles than images seen in the X-ray screen.
6. The console panel contains hard keys which allow screeners to perform certain functions, i.e., turn power on, use threat resolution keys.
7. The CT and X-ray screens contains soft keys(menus) which allow screeners to perform certain functions, i.e., threat resolution keys.
8. The scanner scans baggage so that images can be viewed on the X-ray and CT screens.
9. Threat resolution refers to the process of identifying and recognizing objects that appear to be threats, and making a decision to either clear or hold the bag for further investigation.
10. Threat resolution tool keys are any controls or functions on the CTX 5000 that aid screeners in identifying and recognizing objects. Examples of threat resolution tools are the zoom, sharp X-ray, invert image, or more slices functions.
11. A resolved alarm occurs if a screener is able to determine by use of threat-resolution tools that the baggage does not contain a real threat and is able to clear the bag.
12. An unresolved alarm occurs if a screener cannot determine that there is no threat object and must physically search the baggage to determine if a threat object is inside.
13. A CT slice is a bag image created by the CT scanner when it takes a "slice" picture of the baggage and displays it on the CT screen.

14. When the system alarms, the CTX 5000 automatically displays images taken from the CT scanner (If on HOLD ON ALARM mode). The CT screen will consist of one large CT window and six smaller CT windows. The CT cross-sectional images are the images taken at various slice planes; in this manner all objects in that plane are displayed.
15. The X-ray images that you will be looking at on the CTX 5000 are no different from the X-ray images that you have seen in the past.
16. A shield alarm is very similar to the term “opaque,” which you have already heard. When the CTX 5000 alarms and indicates (on the bottom right corner of the display) that the threat is a shield alarm, the system has detected a dense object that cannot be penetrated. The system is not saying that there is a threat behind the dense object, but that the system does not know what is behind the object. If the shielded area is large enough to conceal a threat, the screener or CTX supervisor should view more images around the object to see if something is hidden.
18. A trackball is a device on the console panel which controls the cursor and allows screeners to point to a specific area on the screen and click (using the trackball buttons) to use threat-resolution tools.

Key Terms

Console panel
CT cross-sectional images
CT screen
Hard keys
Resolved alarm
Scanner and conveyor belt
Shield alarm
Soft keys
Threat resolution
Threat resolution tools
Trackball
Unresolved alarm
X-ray screen

Completion Standards

The lesson will have been successfully completed when, as shown by a successfully completed lesson evaluation, screeners demonstrate a conceptual and operational

understanding of the capabilities and functions of the X-ray screen, the CT screen, and the console panel, as well as the capability to understand frequently used terminology.

Lesson 3 Evaluation

The test items for this lesson block is not included in this document in order to retain confidentiality.

To obtain a copy of the tests, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Lesson 4: X-ray Screening

Objectives	Familiarize screeners with the capabilities of the components and functions of the X-ray screen. Prepare screeners for operational use of the system so that during hands-on operations, they will have an understanding of what the system does.
Lesson Time	Approximately 2 hours
Training Materials & Equipment:	<ol style="list-style-type: none">1. Colored slides or overheads of X-ray screens2. Slide projector or overhead projector and screen3. Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

This lesson provides more detailed descriptions of the X-ray screen than the General Overview of the CTX 5000 (Lesson 3).

1. Read and discuss the lesson objective.
2. [Show Figure 14 and point to each item on the screen] When viewing the X-ray screen you will see the following items on the X-ray display:

NOTE: All items in upper-case letters are actual hard or soft keys or controls. The screeners will use these keys to perform various functions, i.e., threat-resolution, power-up. These keys/controls can be either hard (console panel) or soft keys (X-ray or CT display screens). All items in quotes are display labels, located either on the console panel or display screens, and cannot be activated by the screener. Display labels give the screeners status information, i.e., alarm, scanning of bag, number of threats.

- a) baggage image
- b) image color coding
- c) slice lines
- d) contrast scale
- e) threats
- f) slices
- g) bag status
- h) scanner status

- i) HI-X-RAY POWER
- j) SHARP X-RAY
- k) INVERT IMAGE

Now, I will go over each of the items and describe them to you in further detail. [Show X-ray screen and point to appropriate feature]

3. **Baggage Image.** [Show Figure 14 and point to each item on the screen] The image of the baggage and contents, as mentioned earlier, looks exactly the same as other X-ray screens you have seen. The image is seen upside down from the baggage as positioned on the conveyor belt.
4. **Image Color Coding.** [Show Figure 12 and point to each item on the screen] The CTX 5000 will automatically put a box or border around materials that it thinks are explosives. The following color codes are used:
 - a) The CURRENT threat object always has a *red* border around it.
 - b) OTHER threat objects always have *yellow* borders around them.
 - c) METAL sometimes has *blue* highlighting, depending on density (small items such as buttons may not show up; large objects such as tools will show up).
 - d) DETONATORS are *not color-coded* on the X-ray Screen.
 - e) Current SHIELD ALARMS always have *red* borders around them. Other SHIELD ALARMS will have *yellow* borders around them.

The following table includes the color coding for display images on both the CT and X-ray screen. Images are either color highlighted (whole area is filled in with a color), or have a border, or box around the images (not filled in with color). Notice that the CT and X-ray screens have different color coding.

	CT SCREEN	X-RAY SCREEN
Current Threat	RED highlight/RED border	RED border
Other Threat(s)	RED highlight	YELLOW border
Detonator	GREEN highlight	(not color coded)
Metal	BLUE highlight	May have BLUE highlight
Shield Alarm	YELLOW highlight/RED border	RED or YELLOW border
All material within CT range (including non-expl)	ORANGE highlight (only when activated)	(not color coded)

5. **Slice Lines.** [Show Figure 14 and point to each item on the screen]
 - a) All slice lines are color coded.
 - Red slice lines indicate the presence of a threat in the slice;

- Green slice lines indicate no threat present in the slice;
 - Blue slice lines means that the scanner is acquiring CT slices.
- b) Small blue lines above each green and red slice are used to select CT slices.
 - c) A short slice line (closest to the X-ray image) indicates the slice is displayed as a large CT image. Above this short line will be a small white line.
 - d) [Show Figures 14 and 15 and point to each item on the screen] *The left-most CT slice line is the lowest slice number, and the right-most is the last slice* (these numbers are displayed on CT images).

The large CT image displays the CT slice indicated by a short CT slice line on the X-ray image (fourth slice line). The three right small CT images displayed horizontally on the bottom correspond with the left slice lines (from the slice line that indicates the large CT image). The three small CT images displayed vertically on the right area of the adjacent slices correspond with the right slice lines (from the slice line that indicates the large CT image).

6. **Contrast Scale.** [Show Figure 14 and point to each item on the screen] The contrast scale is on the lower left corner of the screen. It consists of a vertical bar composed of five small boxes ranging from white to black (from top to bottom) with shades of gray in between. There are two ways to use the contrast scale. The image can be changed by pointing a clicking on the desired box, or by clicking down and keeping finger on the click, you can move up and down the scale to the desired contrast level.
7. **Threats,** [Show Figure 14 and point to each item on the screen] The word “threats” is located on the lower *left* corner of the screen. It is followed by a number that indicates the number of potential threats in the baggage that must be examined before clearing the baggage. It is very important that screeners look at this number and check *all* potential threats.

NOTE: The number of threats can also be determined by counting the number of boxes on the X-ray screen.

8. **Slices.** [Show Figure 14 and point to each item on the screen] The word “slices” is located on the lower *left* corner of the screen, immediately below “threats.” Following the word “slices” is a number. This number refers to the number of slices that the CT has scanned and thus, the number of images that the screener can view.

NOTE: The number of slices can also be determined by counting the number of slice lines on the X-ray screen.

9. **Bag Status.** [Show Figure 14 and point to each item on the screen] The word “bag status” is located on the lower *right* corner of the screen. The “bag status” will be either “out” or “in,” which indicates the actual physical location of the baggage.

“Out” means that the baggage has already passed through the scanner and “in” means that the baggage is still inside the scanner.

10. **Scanner Status.** [Show Figure 14 and point to each item on the screen] The words “scanner status” are located on the lower right corner of the screen, immediately below “bag status.” The “scanner status” will be either “off” or “on.” “Off” means that scanning is completed.
11. **HI-X-RAY POWER.** [Show Figure 8 and point to each item on the screen] Another function called HI-X-RAY POWER can be used on the X-ray image. However, the key to this function is not located on the X-ray screen, but rather on the CT screen. The words HI-X-RAY POWER are located in a box in the menu bar in the upper left corner (of the CT screen). Clicking on the HI-X-RAY POWER makes denser objects in the X-ray image appear lighter, and reveals more detail about denser objects. This function may make less-dense objects such as clothing disappear or partially disappear. This function alters the appearance of the X-ray image only, and does not affect CT images.

NOTE: In order to use the HI-X-RAY POWER, the screener must go to the CT screen and click on the HI-X-RAY POWER key. Although the HI-X-RAY POWER key is located on the CT screen, it alters only the X-ray image.

12. **SHARP X-RAY.** [Show Figure 8 and point to each item on the screen] The SHARP X-RAY key, like the HI-X-RAY POWER key, alters images on the X-ray screen but is located on the CT screen. The words SHARP X-RAY are located in a box in the menu bar in the upper left corner. Clicking the SHARP X-RAY sharpens the outlines of objects in the X-ray image. Wires become more clearly visible; however, objects with ill-defined edges may disappear.

NOTE: In order to use the SHARP X-RAY, the screener must go to the CT screen and click on the SHARP X-RAY key. Although the SHARP X-RAY key is located on the CT screen, it alters only the X-ray image.

13. **INVERT IMAGE.** [Show Figure 8 and point to each item on the screen] The words INVERT IMAGE is a box in the menu bar in the upper left corner. Clicking the INVERT IMAGE key reverses white and black in all images on *both* the X-ray and CT screens. The background turns from white to black and the grayscale is reversed.

14. Q&A period.

Summary

In summary, I'd like to review some of the key points that were discussed in this lesson. Please pay careful attention because the following items will be in your lesson evaluation.

1. The CURRENT threat object, on the X-ray screen, always has a *red* border around it.

2. OTHER threat objects, on the X-ray screen, always have *yellow* borders around them.
3. METAL objects, on the X-ray screen, are sometimes highlighted in *blue*, depending on the density of the metal.
4. Shield alarms, on the X-ray screen, will either have a red (current) or yellow (other) borders around them.
5. Slice lines on the X-ray screen, located on the top and bottom of the X-ray screen, are small lines that correspond to the CT images on the CT screen. All slice lines are color coded.
 - Red slice lines indicate the presence of a threat in the slice;
 - Green slice lines indicate no threat present in the slice;
 - Blue slice lines means that the scanner is acquiring CT slices.
6. The contrast scale is located in the lower *left* corner of the screen. It consists of a vertical bar composed of five small boxes ranging from white to black (from top to bottom) with shades of gray in between. There are two ways to use the contrast scale. The image can be changed by pointing and clicking on the desired box, or by clicking down and keeping your finger on the mouse key, you can move up and down the scale to the desired contrast level.
7. In the lower *left* corner of the screen is the word “threat,” followed by a number. This number represents the number of potential threats found in the baggage. You must always look at this number so you know how many threats must be examined.
8. In the lower *left* corner of the screen is the word “slices” (under “threat), followed by a number. This number represents the number of slices that the CT has scanned and thus, the number of images that the screener can view.
9. In the lower *right* corner of the screen are the words “bag status”, followed by the words “out” or “in.” This indicates whether the bag is still in the system or has passed through the scanner.
10. In the lower *right* corner of the screen are the words “scanner status”, followed by the words “on” or “off.” This indicates whether the bag is being scanned or scanning has been completed.
11. HI-X-RAY POWER is a threat resolution tool key that is located on the CT screen but changes images on the X-ray screen. Clicking on the HI-X-RAY POWER makes denser objects appear lighter.
12. SHARP X-RAY is another threat resolution tool key, also located on the CT screen, that changes images on the X-ray screen. Clicking on the SHARP X-RAY sharpens the outlines of objects. Wires become more clearly visible.

13. INVERT IMAGE is also located on the CT screen. Clicking INVERT IMAGE reverses white and black in all images. The background turns from white to black and the grayscale is reversed.

Key Terms

Bag Status

Baggage Image

Contrast Scale

Scan Lines

Scanner Status

Slices

Threat Objects

Threats

Completion Standards

The lesson will have been successfully completed when, as shown by a successfully completed lesson evaluation, screeners are able to locate threat objects, interpret color-coding, match scan lines to smaller CT images, be familiar with and understand display information such as scan lines, contrast scale, number of threats, number of slices, and bag and scanner status.

Lesson 4 Evaluation

The test items for this lesson block is not included in this document in order to retain confidentiality.

To obtain a copy of the tests, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Lesson 5: CT Screen

Objectives	Familiarize screeners with the capabilities of the components and functions of the CT screen. Prepare screeners for operational use of the system so that when hands-on operations begin, they will have an understanding of what the system does.
Lesson Time	Approximately 2-1/2 hours
Training Materials and Equipment	Colored slides or overheads of CT screens
	Slide projector or overhead projector and screen
	Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

This lesson provides more detailed instruction than the General Overview of the CTX 5000 (Lesson 3).

1. Read and discuss the lesson objective.
2. [Show Figure 13 and 33 and point to each item on the screen] When viewing the CT screen you will see the following items:

NOTE: All items in upper-case letters are actual hard or soft keys or controls. These are what screeners will use to perform some type of function, i.e., threat resolution tools, power-up. These keys/controls can be either hard (console panel) or soft keys (X-ray or CT display screens). All items in quotes are display labels, located either on the console panel or display screens and, cannot be activated by the screener. Display labels give the screeners status information, i.e., alarm, scanning of bag, number of threats.

- a) Large CT image
- b) Threat objects
- c) Smaller CT images
- d) Changing Smaller CT Images to Large CT Image
- e) MAIN (COLOR)
- f) COLOR THREAT
- g) COLOR RANGE
- h) COLOR DETON

- i) COLOR METAL
- j) HI-X-RAY POWER
- k) SHARP X-RAY
- l) INVERT IMAGE
- m) Mass
- n) Density
- o) Exp

Now, I will go over each of the items and describe them to you in further detail [Show X-ray screen and point to appropriate feature].

3. **Large CT Image.** [Show Figures 8 and 14 and point to each item on the screen] The image of the baggage and contents on the CT screen look very different from the image on the X-ray screen. Notice the differences between the two images.
4. **Image Color Coding.** [Show Figure 13 and point to each item on the screen] The CTX 5000 will automatically put a box or border around any material that falls within the CT range of explosives. The following color codes are used:
 - a) The CURRENT threat object always has a *red* highlight with a *red* border around it.
 - b) OTHER threat objects always have *red* highlights.
 - c) METAL always has *blue* highlights.
 - d) *Orange* highlights indicate all materials in CT images which fall within the CT range of explosives. This orange highlighting includes those materials which are not identified as a potential explosive because they do not have the right mass.
NOTE: Orange will only appear when the screener uses the COLOR RANGE threat resolution key.
 - e) DETONATORS have *green* highlights, if in the threat area (within the red border). If the detonator is located outside the threat area it will be colored blue.
NOTE: The CTX 5000 does not automatically detect detonators. It will only highlight metal that appears in the bordered threat area. The CTX 5000 assumes that the metal is a detonator and changes the blue to green.
 - f) SHIELD ALARMS are always highlighted in yellow with *red* borders around them.

The following table includes the color coding for display images on both the CT and X-ray screen. Images are either color highlighted (whole area is filled in with a

color), or have a border, or box around the images (not filled in with color). Notice that the CT and X-ray screens have different color coding.

	CT SCREEN	X-RAY SCREEN
Current Threat	RED highlight/RED border	RED border
Other Threat(s)	RED highlight	YELLOW border
Detonator	GREEN highlight	(not color coded)
Metal	BLUE highlight	May have BLUE highlight
Shield Alarm	YELLOW highlight/RED border	RED or YELLOW border
All material within CT range (including non-expl)	ORANGE highlight (only when activated)	(not color coded)

5. **Smaller CT Images.** [Show Figure 15 and point to each item on the screen]. The last lesson covered the correlation of CT images and CT slice lines. However, we'll review one more time how CT images correspond to X-ray slice lines.
 - a) The left-most CT slice line is the first slice number and the right-most is the last slice (these numbers are displayed on CT images), depending on the slice that appears in the large CT window.
 - b) The large CT image displays the CT slice indicated by a short CT slice line on the X-ray image. On the CT screen the three small CT images displayed vertically on the right are those of the adjacent slices to the right of the large CT image. The three right small CT images displayed horizontally on the bottom are of the adjacent slices to the left of the large CT image.
6. **Changing Smaller CT Images to Large CT Image.** There are three ways to select CT slices to be selected as a large CT image. The CT slices are the CT images on the CT screen and are located in the six smaller images, around the large CT image.
 - a) Put the cursor on a small CT image and click.
 - b) Press the PREVIOUS SLICE or NEXT SLICE hard keys on the console panel. Pressing PREVIOUS SLICE displays the CT slice to the left of the current large CT image. Pressing NEXT SLICE displays the slice to the right of the current large CT image.
 - c) Place the cursor on the small blue CT line at the top of the X-ray screen and click
7. **MAIN (COLOR).** [Show Figure 8 and point to each item on the screen]. On the upper left corner of the CT screen there is a vertical bar which represents the menu bar. This menu consists of eight boxes. The first box says MAIN (COLOR), in parentheses, means that the screener is in the Color Menu. For simplicity, just remember that the MAIN (COLOR) menu contains the threat resolution tools and will be the primary menu that screeners will use. Therefore, if the top box does not say

MAIN (COLOR) then the screener should get into the Color Menu (discussed later in procedures section). Screeners will only click on this box if they need to get out of the Color Menu.

8. **COLOR THREAT.** [Show Figure 8 and point to each item on the screen] The words COLOR THREAT are in a box in the menu bar in the upper left corner. Potential threats are initially highlighted in red on CT images. Clicking on the COLOR THREAT soft key turns off the red highlighting and displays threat objects in grayscale.

9. **COLOR RANGE.** [Show Figure 8 and point to each item on the screen] The words COLOR RANGE are in a box in the menu bar in the upper left corner. The COLOR RANGE allows screeners to color in orange all materials in CT images which fall into the CT range of explosives. This orange highlighting includes those materials which are not identified as a potential explosives.

NOTE: The orange highlighting will not override the red highlighting (threat) but will highlight materials in the CT range which are not explosives.

10. **COLOR DETON.** [Show Figure 8 and point to each item on the screen] The words COLOR DETON are in a box in the menu bar in the upper left corner. Potential detonators are initially highlighted in green on CT images. Clicking on the COLOR DETON soft key turns the green highlighting off and displays potential detonators in grayscale.

11. **COLOR METAL.** [Show Figure 8 and point to each item on the screen] The words COLOR METAL are in a box in the menu bar in the upper left corner. Metal is initially highlighted in blue on the CT images. Clicking on the COLOR METAL soft key turns off blue highlighting and displays metal in grayscale.

12. **HI-X-RAY POWER.** [Show Figure 8 and point to each item on the screen] The words HI-X-RAY POWER is a box in the menu bar in the upper left corner. Clicking the HI-X-RAY POWER key makes denser objects in the *X-ray image* appear lighter and reveals more detail about denser objects. This function may make less dense objects such as clothing disappear or partially disappear. This function alters the appearance of the X-ray image only, and does not affect CT images.

NOTE: Although the HI-X-RAY POWER key is on the CT screen, it only affects the X-ray image.

13. **SHARP X-RAY.** [Show Figure 8 and point to each item on the screen] The words SHARP X-RAY are in a box in the menu bar in the upper left corner. Clicking the SHARP X-RAY sharpens the outlines of objects in the *X-ray image*. Wires are more clearly visible. However, objects with ill-defined edges may disappear. Like the HI-X-RAY POWER key, just described, the SHARP X-RAY function also alters the appearance of the X-ray image only, and does not affect CT images.

NOTE: Although the SHARP X-RAY key is on the CT screen, it only affects the X-ray image.

14. **INVERT IMAGE.** [Show Figure 8 and point to each item on the screen] The words INVERT IMAGE are in a box in the menu bar in the upper left corner. Clicking the INVERT IMAGE key reverses white and black in all images on *both* the CT and X-ray screens. The background turns from white to black and the grayscale is reversed.
15. **Mass.** [Show Figure 8 and point to each item on the screen] The word “Mass” is in the lower right box. This information gives the mass (weight) of the potential explosive.
16. **Density.** [Show Figure 8 and point to each item on the screen] The word “Density” is in the lower right box. This information gives the density of the potential explosive.
17. **Exp.** [Show Figure 8 and point to each item on the screen] The abbreviation “Exp” is in the lower right box. This information gives the type of potential explosive that the CTX 5000 has detected. The CTX 5000 classifies potential explosives in either one of the following four classifications.
 - a) Military
 - b) Commercial
 - c) Sheet
 - d) Shield alarms — you should all be familiar with the opaque FAA test objects. A shield alarm is very similar to an opaque object. When the CTX 5000 alarms and indicates (on the bottom right corner of the display) that the threat is a shield alarm, this means that there is a dense object that may be concealing a threat object. This does not mean that there is a concealed threat, but that it does not know what is behind the dense object. If the shielded area is large enough to conceal a threat, the screener or CTX supervisor should view more images around the object to see if something is hidden.

18. Q&A period.

Summary

In summary, I’d like to review some of the key points that were discussed in this lesson. Please pay careful attention because the following items will be in your lesson evaluation.

1. The CT image looks very different from the X-ray image.
2. The left-most CT slice line has the lowest slice number and the right-most has the highest slice number (these numbers are displayed on CT images),. The actual number of these slices depends on the number of the slice that appears in the large CT window.

3. The large CT image displays the CT slice indicated by a short CT slice line on the X-ray image. On the CT screen the three small CT images displayed vertically on the right are of the adjacent slices to the right of the large CT image. The three right small CT images displayed horizontally on the bottom are of the adjacent slices to the left of the large CT image.
4. There are three ways to select CT slices to be selected as a large CT image. The CT slices are the CT images on the CT screen and are located in the six smaller images, around the large CT image.

Put the cursor on a small CT image and click.

Press the PREVIOUS SLICE or NEXT SLICE hard keys on the console panel. Pressing PREVIOUS SLICE displays the CT slice to the left of the current large CT image. Pressing NEXT SLICE displays the slice to the right of the current large CT image.

Place the cursor on the small blue CT line at the top of the X-ray screen and click.

5. The CURRENT threat object always has a *red* highlight with a *red* border around it.
6. OTHER threat objects are always highlighted in *red*.
7. METAL objects are always highlighted in *blue*.
8. DETONATORS are always highlighted in *green*.
9. SHIELD ALARMS are always highlighted in yellow with *red* borders around them.
10. Objects that fall within the CT range of explosives, including those materials which are not identified as a potential explosive are always highlighted in *orange*, only when the COLOR RANGE threat resolution tool is used.
11. The COLOR THREAT key turns off the red highlighting and displays threat objects in grayscale.
12. The COLOR RANGE key allows screeners to color in orange all materials in CT images which fall into the CT range of explosives.
13. The COLOR DETON key turns green highlighting off and displays potential detonators in grayscale.
14. The COLOR METAL key turns off blue highlighting and displays metal in grayscale.
15. The HI-X-RAY POWER and SHARP X-RAY keys, located on the CT screen, affect only the X-ray screen and *not* the CT screen.

16. The INVERT IMAGE key reverses white and black in all images on *both* the CT and X-ray screens.
17. In the lower right corner of the screen is the abbreviation “Exp.” This refers to the type of explosive that the system thinks it has detected.

Key Terms

COLOR DETON (threat resolution tool)
COLOR METAL (threat resolution tool)
COLOR RANGE (threat resolution tool)
COLOR THREAT (threat resolution tool)
Density
Exp
HI-X-RAY POWER (threat resolution tool)
INVERT IMAGE (threat resolution tool)
Large CT Image
MAIN (COLOR) Menu
Mass
SHARP X-RAY (threat resolution tool)
Small CT Image
Threat Objects
Threat Resolution
Threat Resolution Tools

Completion Standards

The lesson will have been successfully completed when, as shown by a successfully completed lesson evaluation, screeners are able to locate threat objects, interpret color-coding, match smaller CT images to scan lines, and be familiar with and understand display information such as explosive type, mass and density, and color menu functions.

Lesson 5 Evaluation

The test items for this lesson block is not included in this document in order to retain confidentiality.

To obtain a copy of the tests, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Lesson 6: Console Panel and Scanner

Objectives	Familiarize screeners with the capabilities of the components and functions of the console panel. Prepare screeners for operational use of the system so that when hands-on operations begin, they will have an understanding of what the system does.
Lesson Time	Approximately 1-1/2 hours
Training Materials & Equipment	<ol style="list-style-type: none">1. Colored slides or overheads of the console panel and scanner2. Slide projector or overhead projector and screen3. Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

This lesson provides more detailed descriptions of the console panel and scanner than the General Overview of the CTX 5000 (Lesson 3).

1. Read and discuss the lesson objective.
2. [Show Figure 5 and point to each item on the screen] When viewing the console panel and scanner you will see the following items:

NOTE: All items in upper-case letters are actual hard or soft keys or controls. These are what screeners will use to perform some type of function, i.e., threat resolution tools, power-up. These keys/controls can be either hard (console panel) or soft keys (X-ray or CT display screens). All items in quotes are display labels, located either on the console panel or display screens, and cannot be activated by the screener. Display labels give the screeners status information, i.e., alarm, scanning of bag, number of threats.

- a) Power controls
- b) Power On indicator
- c) STOP button
- d) Stop indicator
- e) Image display modes
- f) Image display modes and baggage handling
- g) Detection decision lights
- h) Trackball and trackball buttons

- i) Threat resolution tool hard keys
 - j) Threat resolution hard keys
 - k) Scanner
3. **Power Controls.** This switch is labeled OFF/RUN/DISABLE, and is located at the top left of the console panel. It controls daily start-up, shutdown, and disable X-ray. The key guards against unauthorized use of the machine.
 - a) OFF switch. OFF turns the system off. The key can be inserted and removed in this position
 - b) RUN switch (green) . RUN enables the system to scan bags. The key cannot be removed in this position.
 - c) DISABLE X-RAY switch. DISABLE X-RAY prevents X-ray generation. The key can be removed in this position. If the machine is left briefly unattended or it is necessary to climb into the scanner to retrieve a bag, disable X-rays and *remove the key to prevent accidental generation of X-rays.*
 4. **Power On Indicator.** The green Power On indicator is located in the console panel's upper left corner. Its light is on when the system is on.
 5. **STOP Button.** The STOP button is at the top right of the console panel. This button disconnects power for conveyors and X-ray generation. There are seven red mushroom buttons, one button on the console panel, and six on the scanner. When pressing this button, a dialog box will appear on the X-ray screen stating that the emergency stop has been activated.
 6. **Stop Indicator.** When the STOP button has been pressed and is active, its red indicator on the top right of the console panel lights up. A dialog box will appear on the screen indicating that the emergency stop has been activated.
 7. **Image Display Modes.** There are two image display modes, HOLD ON ALARM and ALWAYS HOLD.
 - a) ALWAYS HOLD key. ALWAYS HOLD mode displays all bag images, whether they automatically clear or alarm. The console panel always indicates if a bag clears or alarms. ALL bag images are displayed. Press CLEAR or SUSPECT to discard all bag images.
 - b) HOLD ON ALARM key. HOLD ON ALARM only displays images for alarmed bags. Cleared bag images are automatically discarded. The console panel always indicates if a bag clears or alarms. If a bag alarms, its images remain on screen for threat resolution. In this mode ONLY alarmed bag images are held on screen for operator inspection. Press CLEAR or SUSPECT to discard alarmed bag images.

8. **Image Display Modes and Baggage Handling.** The two image display modes, HOLD ON ALARM and ALWAYS HOLD, work in conjunction with the NEVER HOLD hard key located just above.

- a) NEVER HOLD key. When the NEVER HOLD key is lighted, all bags are automatically unloaded from the scanner onto the holding conveyor, whether they clear or alarm. When the NEVER HOLD key is not lit, bags will now be held in the scanner according to the Image Display mode. When a bag is displayed on screen awaiting operator decision, the bag is held in the scanner. When a bag's images are automatically discarded, the bag is unloaded from the scanner.

NOTE: The NEVER HOLD key does not function alone. Either the ALWAYS HOLD key or the HOLD ON ALARM key must be selected. The following table describes the function of the Image Display Modes (ALWAYS HOLD and HOLD ON ALARM) and the Image Display Modes and Baggage Handling (NEVER HOLD).

KEYS PRESSED AND LIGHTED	IMAGES SHOWN	BAGGAGE HELD
ALWAYS HOLD + NEVER HOLD	Every image	Outside scanner
HOLD ON ALARM + NEVER HOLD	Alarmed images	Outside scanner
ALWAYS HOLD	Every image	Inside scanner until decision made
HOLD ON ALARM	Alarmed images	Inside scanner until decision made

9. **Detection Decision Lights.** [Show Figure 5 and point to each item on the screen]

The top middle of the console panel has the following three vertical detection decision lights:

- a) Clear display (green). When a bag clears, the green clear light on the console panel flashes.
- b) Alarm display (red). When a bag alarms, the red alarm light on the console panel flashes.
- c) Scanning display (yellow). When a bag is being scanned, the yellow scanning light flashes.

10. **Trackball and Trackball Buttons.** Below the detection decision lights is the trackball that moves the on-screen cursor. The cursor is an on-screen arrow or cross-hair that moves between the CT and X-ray screen. It appears as a cross-hair on image displays; on soft keys it appears as an arrow. Two trackball buttons are next to the trackball, one on each side to accommodate right- and left-handed operators. They are used to select and execute a function. To execute, select the function by placing the cursor over it; then briefly click either button and release. The cursor moves between both screens.

11. **Threat Resolution Tool Hard Keys.** To the right of the trackball is a group of five hard keys that comprise threat resolution tool keys. The five keys are as follows:

- a) **MORE SLICES key.** This function allows users to acquire more CT slices anywhere in the bag. These CT slices are acquired at 1 cm intervals.

By pressing MORE SLICES, a default region is defined on the X-ray image around the current threat object boxed in red. The left and right boundaries of the region in which CT slices will be acquired are shown by two vertical ghost lines. By pressing the flashing MORE SLICES, CT slices between the ghost lines can be acquired. Screeners have the ability to move the ghost lines.

- b) **ZOOM function.** The ZOOM key only changes the CT image and not the X-ray image. The large CT image can be zoomed up to the size of the entire CT screen by pressing the ZOOM hard key on the console panel and holding it down. The large CT image fills the entire CT screen. Releasing the ZOOM hard key, returns the image to a large CT image. Zooming can also be done by using only the trackball and clicking on the area. If the large CT image is already magnified by clicking on it with the cursor, the magnified large CT image fills the entire screen.

NOTE: The CT image can be enlarged up to two times its size. For a double enlargement, first click the trackball on the image and then press the ZOOM key on the console panel.

- c) **PREVIOUS SLICE key.** Pressing PREVIOUS SLICE key displays as a large CT image the CT slice to the left of the current large CT image.
- d) **NEXT SLICE key.** Pressing NEXT SLICE key displays as a large CT image the CT slice to the right of the current large CT image.
- e) **NEXT THREAT key.** When there is more than one potential threat in a bag, pressing NEXT THREAT displays as a large CT image the next potential threat object in the bag. Only one threat object at a time is boxed in red on CT images and on the X-ray image; this is the current threat. However, on the X-ray image other threat objects are identified by yellow boxes. Press NEXT THREAT to display each threat in turn as the current threat. The current threat is always boxed in red. After reviewing all threat objects, press NEXT THREAT and all colored boxes disappear. Press NEXT THREAT again to begin reviewing threat objects one by one as before.

12. **Threat Resolution Hard Keys.** Once you have decided if a bag does or does not contain a threat, you press either the SUSPECT or CLEAR key to unload bags from the scanner.

- a) **SUSPECT key.** If you believe that the baggage contains a threat, press the SUSPECT key.
- b) **CLEAR key.** If you believe that the baggage contains no threat, press the CLEAR key.

13. Scanner.

- a) STOP button. The STOP button disconnects power for conveyors and X-ray generator. There are seven red mushroom buttons — six buttons on the scanner and one on the console panel.
- b) X-rays On Indicator. The red lights on the scanner labeled “X-ray On” light up when X-rays are being generated. There are six lights — three on each side of the scanner.

14. Q&A period.

Summary

In summary, I'd like to review some of the key points that were discussed in this lesson. Please pay careful attention because the following items will be in your lesson evaluation.

1. To start up the CTX 5000, turn the OFF/RUN/DISABLE X-RAY switch to the RUN position.
2. If you need to climb into the scanner to remove a bag, use the OFF/RUN/DISABLE X-RAY switch and turn to the DISABLE X-RAY position.
3. To *immediately* stop the CTX 5000, use the STOP button. The light above the button will then turn red.
4. When the yellow scanning light is flashing, the bag is currently being scanned.
5. When the green clear light is flashing, the bag has cleared.
6. When the red alarm light is flashing, the bag has alarmed the system and there may be a potential threat inside the bag.
7. If after viewing a bag you decide that there might be a potential threat inside, you would press the SUSPECT key on the console panel.
8. If after viewing a bag you decide that there are no potential threats inside, you would press the CLEAR key on the console panel.
9. There are two image display modes. The ALWAYS HOLD key allows the system to show EVERY single bag that is placed on the conveyor belt, regardless if it has alarmed or has not alarmed. The HOLD ON ALARM key only shows bag images that the system has alarmed on and thinks that the bag contains a threat.
10. When the NEVER HOLD key is pressed, all bags are automatically unloaded from the scanner onto the holding conveyor, whether they clear or alarm.

11. The MORE SLICES key produces more slice images. For example, if you originally have 7 slices and want to view the object in greater detail, by pressing the MORE SLICES key, you may have up to 15 slice images to view.
12. The ZOOM key allows you to enlarge images on the large CT image box.
13. The PREVIOUS SLICE key allows you to go back to the last slice you were viewing. If you want to go to the next slice, press the NEXT SLICE key.
14. When there are more than one threat in the baggage, you need to view ALL threats. To view the next threat, you would use the NEXT THREAT key.

Key Terms

ALWAYS HOLD

CLEAR (threat resolution key)

Conveyor Belt STOP Button

Detection Decision Lights

DISABLE X-RAY

HOLD ON ALARM

Image Display Modes

MORE SLICES (threat resolution tool)

NEVER HOLD

NEXT SLICE (threat resolution tool)

NEXT THREAT (threat resolution tool)

OFF

PAUSE (threat resolution tool)

Power Controls

Power On Indicator

PREVIOUS SLICE (threat resolution tool)

RUN

Scanner

STOP Button

Stop Indicator

SUSPECT (threat resolution key)

Threat Resolution Keys

Threat Resolution Tool Keys
Trackball and Trackball Buttons
X-rays On Indicator
ZOOM (threat resolution tool)

Completion Standards

The lesson will have been successfully completed when, as shown by a successfully completed lesson evaluation, screeners are able to locate and know how to operate all controls on the console panel, which include start-up and shutdown, baggage mode keys, threat resolution tool keys, and threat resolution keys. Screeners should also know the meanings of indicator lights.

Lesson 6 Evaluation

The The test items for this lesson block is not included in this document in order to retain confidentiality.

To obtain a copy of the tests, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Lesson 7: Explosives and Components

Objectives	Familiarize screeners with the configurations, components, and functions of explosives, with the aid of demonstration explosive simulants and inert IED components.
Lesson Time	Approximately 1-1/2 hours
Training Materials & Equipment	<ol style="list-style-type: none"> 1. Modular Bomb Set (MBS) and other materials: [Excluding the four explosive simulants] <ul style="list-style-type: none"> Power sources: <ul style="list-style-type: none"> AA AAA 9V Polaroid Polarpulse Timers: <ul style="list-style-type: none"> Pocket watch Travel alarm Large clock Blasting cap 2. Inert explosives: <ul style="list-style-type: none"> Smokeless powder AN gel/emulsions Black powder Detasheet NG dynamite TNT Semtex Comp C-4 Chlorate mixtures Incendiaries 3. Other inert explosive devices: <ul style="list-style-type: none"> Non-electric blasting cap (shock tube fuse cap) Micro-detonator Pipe bomb container Electric shave power chord (use coil) Satch batteries 555 E-Cell Other digital timers Mechanical timer Various types and lengths of wires 4. List of MBS combinations and simulants (48 possible) plus 48 combinations using the other materials 5. Four bags representing each of the four basic bomb groups 6. Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

1. Read and discuss the lesson objective.
 - a) Explosive charges
 - b) Detonators
 - c) Power supplies
 - d) Timers/switches
 - e) Containers
 - f) Shield alarms
 - g) Four basic bomb groups
2. Emphasize that purpose of the CTX 5000 system is to alert screeners when a bag contains material that might be an explosive. Screeners must then determine if the object highlighted by the CTX 5000 is (a) an explosive, (b) part of an explosive device, or (c) a false alarm.
3. General description and hands-on demonstration. Inert explosives and IED devices of all the types listed below should be physically present so that screeners may view and feel them as they are being discussed.

Explosive charges (that the CTX 5000 can detect).

High explosives:

- a) Bulk
- b) Military
- c) Commercial
- d) Improvised (sheet, boosters)

Low explosives:

- a) Smokeless and black powders
- b) Chlorate mixtures
- c) Incendiaries

Detonators (blasting caps). Detonators are typically blasting caps which are normally 1/4" wide by 1-4" long.

- a) Electric
- b) Non-electric: Shock tube and Specialty (e.g., micro detonators)

Power Supplies.

- a) 9V
- b) AA
- c) AAA
- d) Polaroid Polarpulse (flat battery)
- e) Watch battery
- f) Other

Timers/Switches.

- a) 555
- b) E-Cell
- c) Digital timer (e.g., kitchen, wristwatch)
- d) Mechanical (assorted)
- e) Barometric
- f) Other

Containers.

- a) Pipe bombs (e.g., PVC, galvanized)

- 4. Explain shield alarms.
- 5. Emphasize to screeners that these four components (explosive charge, detonator, power supply, timer/switch) can be combined in many ways to form explosive devices.
- 6. Describe and show samples of each of the four basic bomb groups.
 - a) Open devices — No artful concealment; just in container.
 - b) Closed (contained) devices — Artful concealment, e.g., electronic items.
 - c) Sympathetic (detonation) devices— (1) Power supply, switch and detonator in a concealment; (2) Bulk charge in close proximity (may or may not be concealed).
 - d) Suitcase devices— Components concealed in the baggage; bag is a bomb.

NOTE: This training course focuses primarily on *open devices*, with minimal explanation and demonstration of closed devices. Training in the three other bomb groups (closed, sympathetic, and suitcase devices) will be taught in another training course. Instructors should emphasize to screeners, however, that it is important that they understand and be aware of all four groups.

7. Show various combinations of the MBS components. There are 48 possible combinations using the MBS components. Instructors are not required to use any specific combinations for demonstrations, but rather should form their own combinations. Screeners should be shown at least ten to fifteen different combinations (which may include the list of ten combinations below). The following examples of MBS combinations are the same that are used in FAA testing:
- a) Dynamite, Polaroid battery and digital travel alarm.
 - b) Dynamite, 9-volt battery and small analog pocket watch.
 - c) TNT, 9-volt battery and analog travel clock.
 - d) TNT, two 1.5 volt batteries and analog pocket watch.
 - e) C-4, Polaroid battery and large clock.
 - f) C-4, Polaroid battery and digital travel alarm.
 - g) C-4, two 1.5 volt batteries and analog travel clock.
 - h) Sheet explosive, Polaroid battery and digital travel alarm.
 - i) Sheet explosive, 9-volt battery and analog pocket watch.
 - j) Sheet explosive, two 1.5 volt batteries and digital travel alarm.

NOTE: All ten configurations should include the detonator which is placed into the explosive simulant.

8. Emphasize to screeners the following points:
- a) This is only a sample of what you will see in training — there are many more combinations, so you should not fixate on these particular samples. It is very likely that if you were to encounter a real bomb, it would be different from the samples you are seeing today.
 - b) Just to show you how many combinations there are, look at the following table. You can choose any one item from each of the four columns to create a new bomb. This equals 96 possible combinations. This table does not include all possible components either. Also, when you consider that explosive charges can be shaped into any shape or placed in any type of container, the amount of possible combinations far exceeds 96. Remember that the number of possible combinations is limited only by the bombmaker's imagination!

COLUMN 1 Explosive Charge	COLUMN 2 Power Sources	COLUMN 3 Timers	COLUMN 4 Blasting Cap
Smokeless powder	AA	Pocket watch	Blasting Cap
AN gel/emulsions	AAA	Travel alarm	
Black powder	9V	Large clock	
Detasheet	Polaroid Polarpulse		
NG dynamite			
TNT			
Semtex			
Comp C-4			

Detecting MBS components will be more difficult than detecting the conventional FAA test items. However, a real bomb might be even more difficult to detect than the MBS combinations that you are seeing now.

9. Q&A period.

Summary

In summary, I'd like to review some of the key points that were discussed in this lesson. Please pay careful attention because the following items will be in your lesson evaluation.

1. The four basic components that are needed to build a bomb are an *explosive charge*, a *detonator*, a *power supply*, and a *timer/switch*.
2. Any of these four basic component parts can be used in combination to form many types of bombs.
3. Explosives can be either HIGH explosives or LOW explosives. Some high explosive categories include bulk, military, commercial, and improvised. Some low explosive categories include smokeless and black powders, chlorate mixtures, and incendiaries.
4. Plastic explosives can be shaped in any form and can, therefore, be easily hidden.
5. Detonators, or blasting caps, can be either electric, non-electric, shock tubes, or specialty detonators.
6. Power supplies can be batteries, such as 9V, AA, AAA, Polaroid Polarpulse (flat battery), or watch batteries.
7. Timers or switches can be 555, E-Cell, digital timers, mechanical, or barometric.

8. Containers may be in the form of pipe bombs.
9. There are four basic bomb groups:
 - a) Bulk
 - b) Military
 - c) Commercial
 - d) Improvised (sheet, boosters)
10. *Open devices* is when there is no artful concealment and the threat is just in the container.
11. *Closed, or contained, devices* is when there is artful concealment (electronic items).
12. *Sympathetic, or detonation, devices* are when the power supply, switch, and detonator are concealed, and the explosive charge is in close proximity (may or may not be concealed).
13. *Suitcase devices* are when the components are concealed in the baggage. The bag is the bomb.
14. The modular bomb set contains different types of explosive charges, detonators, power switches, and timers/switches. These sample parts can be combined in many ways to build a bomb.
15. Probably the most important thing to remember is that the examples of basic component parts that you have just seen are just *some* of the devices that can be used to make a bomb. There are many more types of devices that can be used that were not shown to you. Remember that the number of combinations is limited only by the bombmaker's imagination. You should not assume that all bombs will look like the ones you have seen today.

Key Terms

Closed (contained) Devices

Containers

Detonators

Explosive Charges

Four Basic Explosive Groups

Modular Bomb Set (MBS)

Open Devices

Power Supplies

Shield Alarms

Suitcase Devices

Sympathetic (detonation) Devices

Timers/Switches

Completion Standards

The lesson will have been successfully completed when, as shown by a successfully completed lesson evaluation, screeners demonstrate the ability to identify and distinguish between military, commercial, and sheet explosives, and are able to identify detonators, initiators, booster charges, and shield alarms when viewing demonstration objects.

Lesson 7 Evaluation

The test items for this lesson block is not included in this document in order to retain confidentiality.

To obtain a copy of the tests, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Lesson 8: Non-Explosive CT and X-ray Images

Objectives	Familiarize screeners with CT and X-ray screen images and to compare those images to real demonstration objects.
Lesson Time	Approximately 2-1/2 hours
Training Materials & Equipment	<ol style="list-style-type: none">1. Colored slides or overheads of corresponding CT and X-ray images2. Slide projector or overhead projector and screen3. Demonstration objects, e.g., cut shoes, glasses, plates4. Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

The instructor should give exercises which involve screeners in identifying threat location, recognizing objects, and resolving images by using demonstration objects, and then comparing them to corresponding images on screen.

1. Read and discuss the lesson objective.
2. CT and X-ray images.
3. General Rules of Thumb and Concepts.

There are certain general rules and concepts that will help you identify objects. You should remember them. It is important to note that these general rules and concepts may not always apply (with the exception of the prioritization rule) and should, therefore, be looked upon more as rule of thumbs for aiding in threat resolution.

- a) **Common Objects Rule of Thumb.** Certain items are more frequently seen at certain airports. You will see many of the same types of items, particularly types of foodstuffs (San Francisco—wine; Belgium—chocolates)
- b) **Grouping Rule of Thumb.** Grouping objects may be grouped in two ways.
 - *Similar Groupings.* Most bags that you see will consist of similar groupings of items. People tend to pack similar types of items together, — i.e., toiletries, foods, electronics, books, close together or in the same area.
 - *Odd Groupings.* Most of the time you will see similar objects packed together. If you see objects packed near each other that do not seem to fit together — i.e., a canned good mixed with all electronic equipment, be sure to examine the bag very carefully. It is unusual for objects to be oddly grouped and may indicate the presence of a potential threat.

- c) **Familiarity Rule of Thumb.** You will begin to see commonly recognized objects repeatedly — look for something that *looks different* or *stands out* from the normal. Explosives will look different because you will rarely see them.
- d) **Prioritization Rule.** The system does not indicate prioritization of threats — all threats have equal priority. You must look at *all* threats if there is more than one threat in a bag.

The following objects are commonly seen non-explosive, non-threat objects:

NOTE: Emphasize to screeners that although these commonly seen objects are *normally* non-threat objects, they should *not assume* that there is no threat. For example, if the CTX 5000 highlights the metal plates in a pair of shoes, screeners will tend to immediately recognize the item as a pair of shoes and disregard the image. However, threat objects are often concealed in commonly seen objects, such as shoes, bottles, or cans. Screeners must consider that there is a possibility for all objects to be potential threats!

- a) **Air.** Always a light gray or white color.
- b) **Electronics.** Should appear empty; contain a great deal of air in it — should not have any red inside. Electronics have a lot of metal inside and will typically be blue (or green if within the threat object area).
- c) **Books.** Should be able to see actual pages and identify it. For example, the object is a book, binder, magazine, dog-eared.
- d) **Shoes.** Metal plates in shoes are different in shape and color than detonators.
- e) **Cans.** May have a dark red edge and light pink middle — not enough metal to be blue. They will have a thick dark edge around them (as well as other perfectly round objects).
- f) **Bottles.** Also may have a dark red edge and light pink middle — will appear thicker than cans because of the glass.
- g) **Liquids.** Look for liquids — they may help to identify cans, bottles, and other foodstuffs. They can have a gray or pink color.
- h) **Liquid densities.** Thicker liquids have a rougher surface than thinner liquids (i.e., creams, vs. water which will have a straight-edge surface).
- i) **Clothes.** Clothing appears as light gray lines loosely packed together.

More information on detecting explosives in CT images:

- a) Always look at objects around an explosive.
- b) The system will detect potential explosives. Detonators are secondary and will be colored green.
 - Use the MORE SLICES key to find a detonator (i.e., radio with explosive and metal).

- The detonator should always touch or be inside the red area. If green object is completely separate from the red area, it *may not* be a detonator.
- c) Concurrently show CT images and demonstration objects; hold up to screen so that screeners can compare the physical object to the CT image. For each image displayed, apply the general rules and concepts so that screeners gain a greater understanding of these rules and concepts. Make sure students always view both images.

Commonly seen non-threat objects.

- clothes
- shoes
- books and magazines
- computers
- radios
- walk-man radios
- toiletries (i.e., toothpaste, toothbrush, combs and brushes, make-up)
- irons
- hair dryers
- video cassettes, CDs, and tapes
- wine bottles
- candies
- canned goods

Non-explosive threat objects.

- firearms
- hazardous materials

Shielded objects.

The X-ray opaque image might be cleared by inspecting around it in the CT image for a detonator or other components.

4. Q&A period.

Summary

In summary, I'd like to review some of the key points that were discussed in this lesson. Please pay careful attention because the following items will be in your lesson evaluation.

1. Air usually appears light gray or white.

2. Electronic equipment usually appears empty and have a great deal of air in it. If you ever see red or green inside, be very suspicious.
3. Thicker liquids (lotions) will always look rougher than thinner liquids (water), which will look smoother.
4. Whenever a green area (possible detonator) is close to a red area (explosive material) you should be very concerned. Real bombs will have detonators that are touching or inside the explosive. If the green object is completely separate from the red area, it may not be a detonator.
5. The grouping rule of thumb refers to the fact that people tend to pack similar types of items together, i.e., toiletries, foods, electronics, books. This is what most bags will look like. However, when you see a bag that is oddly grouped, be suspicious that the bag may contain a threat. It is rare that objects in baggage are oddly grouped.
6. The familiarity rule of thumb refers to the fact that objects that look very familiar to you will probably not be threats. You will become more familiar with commonly seen objects, so when you see something that looks different or stands out from the normal, you should be very concerned. Explosives will probably look different.
7. The common objects rule of thumb refers to the fact that certain items are more frequently seen at certain airports. You will see many of the same types of items, particularly types of foodstuffs (San Francisco/wine; Belgium/chocolates)
8. The prioritization rule refers to the fact that the system does not indicate prioritization of threats — all threats have equal priority of being a threat. You must look at *all* threats if there is more than one threat in a bag

Key Terms

Common Objects rule of thumb

Familiarity rule of thumb

Grouping rule of thumb

Prioritization rule

Completion Standards

The lesson will have been successfully completed when, as shown by a successfully completed lesson evaluation, screeners demonstrate the ability to successfully identify both commonly seen objects and explosives and IED components on the CT images as seen either on a screen (by using either slide or computer images of the CT screen, or on the actual CT screen). Screeners should be encouraged to speak up when they can identify objects.

Lesson 8 Evaluation

The test items for this lesson block is not included in this document in order to retain confidentiality.

To obtain a copy of the tests, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Lesson 9: Threat Resolution Protocol and Decision Criteria

Objective	Inform screeners as to what certainty level criteria warrants action to be taken on an object that they believe is a threat object. In other words, how certain must the screener be in order to let an unresolved alarm pass through the system vs. taking action for further inspection.
Lesson Time	Approximately 3-1/2 hours
Training Materials & Equipment	<ol style="list-style-type: none">1. Threat resolution protocol flow diagram2. Colored slides or overheads3. Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

Due to its sensitivity, the lesson content is not included in this document.

To obtain a copy of the lesson content, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Lesson 9 Evaluation

Not included in this document.

To obtain a copy of the lesson, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Lesson 10: Protocol for Handling Potential Threat Objects

Objective	Inform screeners of the necessary step-by-step procedures they should take when encountering either positive alarms or unresolved alarms that are believed to be potentially hazardous. This includes information and procedures on notification of appropriate persons (e.g., LEO, CTX supervisor), baggage searches, evacuations, and handling of passengers and baggage.
Lesson Time	Approximately 1-1/2 hours
Training Materials & Equipment	Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

The material in this section will vary from site to site. The information presented here is for illustrative purposes only.

1. Read and discuss the lesson objective.
 - a) Positive alarm (explosive devices)
 - b) Hazardous Materials (HAZMAT)
 - c) Baggage search for an unresolved alarm
 - d) Non-explosive threats
 - e) Baggage search procedures
2. Positive alarm (*explosive devices*). If the CTX 5000 operator decides that the alarmed object is a potential IED, the following procedures should be conducted.
 - a) The CTX 5000 operator should call an CTX supervisor.
 - b) This CTX supervisor will decide if the baggage contains a potential threat and should be treated as a live device.
 - c) If the baggage is believed to contain a threat, the CTX supervisor or CTX 5000 screener should take more slices and save all images before removing the bag from the scanner.
 - d) The CTX supervisor will contact the lobby supervisor.
 - e) The United Airlines lobby supervisor will then call the Airport Emergency (dispatcher) to request a K-9 unit.

- f) The K-9 unit will arrive within thirty minutes and determine if the bag contains an explosive device. Once the K-9 unit believes there may be a potential threat, they will be responsible for the bag. If they decide it is not a potential threat (but the threat is still unidentified), the bag will be turned over to the airline who may then conduct a hand search.
3. Hazardous Materials (HAZMAT).
- a) *HAZMATS* — Include firearms and weapons, spray paint, scuba tanks over 40 psi, motorcycle batteries, and oxygen bottles. Procedures are the same as for the conventional X-ray machine.
 - b) *Wine Bottles* — Procedures are the same as for the conventional X-ray machine.
4. Baggage search procedures for an unresolved alarm. If the screener is unable to identify an object and believes that the object is a potential threat, a baggage search should be conducted. The following presents a general guideline:
- a) Conduct the bag search only in a *private area* away from other passengers and airline staff [location to be determined by United Airlines]
 - b) Only open or search checked baggage with the *passenger present*. Compare the passenger's travel documents (passport), ticket, bag tag stubs, and tag on the suspect bag to make sure that all agree. If they do not agree in any way, notify an CTX supervisor.
 - c) *Two security agents* should always be present during the search, one to actually search the bag and the other to observe the passenger and witness the events. Whenever possible, a male security agent should search males' bags and a female security agent search females' bags. This is not only for propriety, but for familiarization with baggage contents. Also, whenever possible, the screener or CTX supervisor who selected the bag for search on the CTX 5000 should either do or witness the search.
 - d) Maintain a written record of the bag search protocol (name of passenger, type of bag, time of search, security agents present, what the threat object turned out to be).
 - e) Observe the passenger for any unwarranted signs of nervousness, anxiety, or fear. If the passenger appears to be acting strangely or rushing the search procedure, call the CTX supervisor immediately.
 - f) Ask the passenger to first positively identify the bag as belonging to him or her and to open it. If the passenger is unfamiliar with how to open the bag or does not have the key or combination, call your CTX supervisor or the LEO.
 - g) Familiarize yourself with the display of the "threat object" on the remote display system (RDS) and its relationship to a bag characteristic, such as a handle or hinge. From the RDS display you should be able to determine the relative size of

the threat object. If the RDS is not functioning, the searcher should retrieve the saved image of the treat bag on the CTX 5000.

- h) If the threat object appears to be part of the wall or outside of the bag, do not attempt to clear it yourself. Call the canine unit.
 - i) Never show the passenger the threat object on the RDS or explain the CTX 5000 in any detail. Never tell the passenger that the CTX 5000 alarmed for the possible presence of a certain type of explosive.
 - j) Once you think you have located the threat object, examine it for any signs of wiring, detonators, or unusual smells or oiliness. If the threat object appears to be innocuous, remove it from the bag and run the bag again through the CTX 5000 to ensure that it does not alarm and that you have found the right threat object.
 - k) If the threat object can be visually cleared as having no suspicious signs, then it can be returned to the bag after the bag has been run through the CTX 5000 again without alarming. However, the threat object should always be placed in a different section of the bag as a precaution.
 - l) If the threat object cannot be visually resolved to be a non-threat, but there are no obvious, suspicious signs, then the threat object should be run by itself through the CTX 5000. Special attention should be given to the zoom X-ray to ensure that the object contains no wires or metallic items.
 - m) If the threat object has any suspicious signs, such as wires coming out of it, call the LEO.
 - n) If the threat object appears to be inside of an electrical or electronic device, you cannot clear it. The LEO must be notified and clear the item.
 - o) If at any time the threat object, bag, or passenger seems suspicious — call an LEO for final clearance.
 - p) If the threat object is cleared and returned to the bag, ensure that the passenger does not add anything to the bag before it is closed and locked. The bag should then be sealed with security tape before sending to the baggage make-up area.
5. Have the two screeners volunteer to do a bag search while the instructor reads the bag search protocol.
6. Non-explosive threats (e.g., firearms, bullets, gun powder, hazardous materials).
7. Q&A period.

Summary

In summary, I'd like to review some of the key points that were discussed in this lesson. Please pay careful attention because the following items will be in your lesson evaluation.

1. If you feel confident that there is an explosive device in a baggage, you should first call the CTX supervisor.
2. If the CTX supervisor believes there is a potential threat, more slices should be taken and all images should be saved, before removing the bag. The CTX supervisor will then call the Shift Manager to request a K-9 unit.
3. If the K-9 unit determines that there is no potential threat, the bag will be handed over to the airline who may then decide to conduct a bag search as follows:
 - a) Conduct bag searches only in a private area away from other passengers and airline staff.
 - b) You should try to have the passenger present when you search the bag. However, if you suspect there is a threat in the bag, you may search the bag without the passenger present. You should wait at least ten minutes before conducting the search without the passenger.
 - c) Confirm that the baggage belongs to the passenger by comparing the passenger's travel document (passport, etc.), ticket, bag tag stubs, and tag on the suspect bag to make sure that all agree. If they do not agree in any way, notify the CTX supervisor.
 - d) Two security agents should always be present during the search, one to actually search the bag and the other to observe the passenger and witness the events. Whenever possible, a male security agent should search males' bags and a female security agent search females' bags. This is not only for propriety, but for familiarization with baggage contents. Also, whenever possible, the security agent who selected the bag for search on the CTX 5000 should either do or witness the search.
 - e) A written record should be completed after the baggage search. This record should include the name of the passenger, type of bag, time of search, security agents present, what the threat object turned out to be, etc.
 - f) You should always observe the passenger for any unwarranted signs of nervousness, anxiety, or fear. If the passenger appears to be acting strangely or rushing the search procedure, immediately call your CTX supervisor.
 - g) Never show the passenger the threat object on the RDS or explain the CTX 5000 in any detail. And, never tell the passenger that the CTX 5000 alarmed for the possible presence of a certain type of explosive.
 - h) If the threat object appears to be part of the wall or outside of the bag, never attempt to clear it yourself. Call your CTX supervisor or LEO.

- i) Once you think you have located the threat object, examine it for any signs of wiring, detonators, or unusual smells or oiliness. If the threat object appears to be innocuous, remove it from the bag and run the bag through the CTX 5000 again to ensure that the system does not alarm and that you have found the right threat object.
- j) If the threat object can be visually cleared as having no suspicious signs, the object can be returned to the bag after the bag has been run through the CTX 5000 again without alarming. However, as a precaution, the threat object should always be placed in a different section of the bag.
- k) If the threat object cannot be visually cleared but has no obvious suspicious signs, the threat object should be run by itself through the CTX 5000. Special attention should be given to the zoom X-ray to ensure that the object contains no wires or metallic items.
- l) If the threat object has any suspicious signs, such as wires coming out of it, or if the object appears to be inside of an electrical or electronic device, call your CTX supervisor or an LEO.
- m) If the threat object is cleared and returned to the bag, you should make sure that the passenger does not add anything to the bag before it is closed and locked.
- n) Before sending the cleared baggage to the make-up area, ensure that the bag is sealed with security tape.

Key Terms

K-9 Units

Completion Standards

The lesson will have been successfully completed when, as shown by a successfully completed lesson evaluation, screeners demonstrate that they understand the step by step procedures they should take when encountering either positive alarms or unresolved alarms that are believed to be potentially hazardous. This includes information and procedures on notification of appropriate persons (e.g., LEO, CTX supervisor), baggage searches, evacuations, and handling of passengers and baggage.

Lesson 10 Evaluation

The test items for this lesson block is not included in this document in order to retain confidentiality.

To obtain a copy of the lesson, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Lesson 11: CTX 5000 Operational Procedures/Fault Recovery

Objective	Familiarize screeners with the necessary step-by-step procedures for operating the CTX 5000, including daily start-up, daily shutdown, threat resolution tools, and fault recovery. The instructor will go over each task to prepare screeners for operating the system.
Lesson Time	Approximately 2-1/2 hours
Training Materials & Equipment	Copies of lesson evaluation

NOTE: The instructor should, throughout the lesson, continuously quiz screeners on material being taught to ensure that screeners are understanding the material.

Content

1. Read and discuss the lesson objective.

NOTE: You will be instructed to use the following procedures during training [sequence demonstrated is completely arbitrary]; however, once you are more familiar with the system, you may use whatever sequence or strategy that works best for you. Instructors should make sure that screeners follow procedures exactly to ensure that each step has been completed. To help guide screeners through the operational procedure, a support sheet containing the operational procedures will be provided to screeners during hands-on operations, as well as at the airport CTX 5000 site (in a secure location and easily accessible to screeners).

2. **Power Up.**
 - a) Turn system on (turn to RUN position on switch).
 - b) The X-ray and CT monitors appear and the lights on the console panel turn on.
3. Press RESTART SOFTWARE soft key on computer monitor (under the Fault Menu). In 3 minutes, the scanner will initialize itself and conveyors will become active automatically.
4. The default scanning mode is NEVER HOLD ON and HOLD ON ALARM. In the default mode, *cleared bags* are unloaded and sent on to the airport conveyor without operator intervention. Validate that baggage loading mode is correct mode. Both the NEVER HOLD and the HOLD ON ALARM hard keys should be lit.
5. **Baggage loading.**
 - a) Place bag on conveyor belt.
 - b) Use hand unit (press INSERT key).

- c) Is bag oversized? [Oversized bags are automatically detected. The box or bag will stop on the infeed conveyor. All bags in line stop.] Position the oversized bag for its entry, or remove it. Then press the READY button on hand set. Continue on with the following steps below.
 - If no, continue on.
 - If yes, position the oversized bag for its entry, or remove it. Then press the READY button on hand set. Continue on.
 - d) Does bag jam at the infeed?
 - If no, continue on.
 - If yes, press the E-STOP button on the wall. Correct the jam. Pull out the E-STOP button on the wall. If the yellow button light on the infeed conveyor is on, press it. Continue on.
6. **Indicator Lights on Ceiling.** Screeners should pay attention to the indicator lights on the ceiling and know what each of the colored lights represent.
- a) Blue Light means that the bag sitting on the outfeed conveyor is waiting for an operator decision.
 - b) Green light means that the bag sitting on the outfeed conveyor is clear and will be automatically sent onto the airport's exit conveyor.
 - c) Red light means that the operator has pressed the SUSPECT button. After inspecting or removing the bag always press the green outfeed conveyor button to resume screening after a suspect bag.
 - d) Flashing red light means the system has a fault or is recovering from a fault. There may or may not be a bag on the outfeed. If the system does not correct this problem automatically, press the green outfeed conveyor as many times as needed (if bags are still going to the outfeed) until the red light stops flashing. Press the green outfeed button 4-5 times, or more if need be.
 - e) Flashing red light may also mean that a bag has been removed or the system has to clear/reset the outfeed conveyor and the green outfeed conveyor button was not pressed. Unless the airport's conveyor is stopped, press this button as many times as needed until the red lights stops flashing.
7. **Machine Alarm?**
- a) Is red alarm light blinking on the console panel?
 - b) Is there an auditory warning signal?
 - If no, CLEAR bag and load or view new bag.
 - If yes, continue on with the following steps below.

8. Threat Resolution Tools.

- a) Do you recognize the object?
 - If yes, either press CLEAR key to clear bag or press SUSPECT key to hold bag for further inspection.
 - If no, continue using as many threat resolution keys as necessary, on both the CT and X-ray screens, until the potential threat object is recognized. Continue on with the following steps below.

9. CT Screen.

- a) Look at explosive type to aid in locating and identifying object.
- b) Look at threats to determine how many potential threats you need to examine.
- c) Look for object with a *red box* around it. This is *current* threat if there are multiple threats.
- d) Use threat resolution tool keys:
 - ZOOM. Try both ways of zooming.
 - Click on object using trackball. Click again to get out of zoom mode.
 - Hold down ZOOM key on console panel. Release ZOOM key to return to normal size.

Click on COLOR THREAT soft key. Click again to get out of COLOR THREAT mode.

Click on COLOR RANGE soft key. Click again to get out of COLOR RANGE mode.

Click on COLOR DETON soft key. Click again to get out of COLOR DETON mode.

Click on COLOR METAL soft key. Click again to get out of COLOR METAL mode.

Click on INVERT IMAGE soft key. Click again to get out of INVERT IMAGE mode.

- e) Look for green object. This is a possible detonator. Is it near or in the red area?
- f) There are three ways to select CT slices to be selected as a large CT image. The CT slices are the CT images on the CT screen and are located in the six smaller images, around the large CT image.

Put the cursor on a small CT image and click.

Press the PREVIOUS SLICE or NEXT SLICE hard keys on the console panel. Pressing PREVIOUS SLICE displays the CT slice to the left of the current large

CT image. Pressing NEXT SLICE displays the slice to the right of the current large CT image.

Place the cursor on the small blue CT line at the top of the X-ray screen and click.

- g) If at this point, you still cannot resolve the alarm, you will need to view more slices. The MORE SLICES function is located on the console panel and is used to acquire more CT slices anywhere in the bag. These CT slices are acquired at 1 cm intervals.

- h) Look for object which is *highlighted* in red. This is *other* threat.

Press NEXT THREAT key.

Click on other threat (highlighted in red).

10. X-ray Screen.

- a) Look for object with a *red box* around it. This is *current* threat if there are multiple threats.

- b) Use threat resolution tools:

ZOOM. Try both ways of zooming.

- Click on object using trackball. Click again to get out of zoom mode.
- Hold down ZOOM key on console panel. Release ZOOM key to return to normal size.

Point cursor to vertical contrast scale boxes to change contrast. There are two ways to use the contrast scale. The image can be changed by pointing a clicking on the desired box, or by clicking down and keeping finger on the click, you can move up and down the scale to the desired contrast level.

Click on SHARP X-RAY soft key (located on CT screen). Click again to get out of SHARP X-RAY.

Click on HI-POWER X-RAY soft key (located on CT screen). Click again to get out of HI-POWER X-RAY.

- c) Look at threats again to determine how many *other* threats need to be examined. Then look for object with a *yellow box* around it. This is *other* threat.

Press NEXT THREAT key.

Click on other threat (highlighted in red).

Continue looking at *each* threat in the bag until all threats have been resolved.

11. Threat Resolution.

- a) After having completely examined all potential threat objects, using all threat resolution tools, does the object have the characteristics to be a real threat?
 - If no, press CLEAR key to clear bag and continue on to next bag.

- If yes, press SUSPECT key to hold bag for further inspection and immediately call a supervisor.

12. Daily Shut Down.

- a) Turn the key switch on the console panel to OFF position and remove the key and return it to its storage location to ensure against unauthorized use.
- b) The X-ray and CT monitors turn off and the lights on the console panel turn off.

13. Fault Recovery.

- a) A fault can be caused by a variety of reasons, such as a bag jam or a software error. Faults are indicated by a *fault dialog box* on the X-ray screen.
- b) To recover from a fault, first click the fault dialog box's ACKNOWLEDGE soft key.
- c) Take the required steps to correct the problem, such as removing a jammed bag.
- d) Click on the FAULT RESET soft key on the fault menu. WAIT 30 SECONDS for operations to resume (the soft key's dot stops flashing).

WARNING: DO NOT PRESS THE FAULT RESET KEY BEFORE THE DOT HAS STOPPED FLASHING!

- e) During FAULT RESET, a DIEBACK may occur, displayed as a *fault dieback* on the X-ray screen. Press the GREEN OUTFEED CONVEYOR button to remove the dieback.
- f) If the fault is not corrected by clicking FAULT RESET, click on the RESTART SOFTWARE (restart software) soft key on the fault menu. A dialog box will appear on the X-ray screen confirming if software is to be restarted. Click on YES. Wait patiently for 3 minutes to resume screening operations after the X-ray and CT screens reappear and the scanner is ON.

14. Q&A period.

Summary

In summary, I'd like to review some of the key points that were discussed in this lesson. Please pay careful attention because the following items will be in your lesson evaluation.

Key Terms

N/A

Completion Standards

The lesson will have been successfully completed when, as shown by a successfully completed lesson evaluation, screeners demonstrate that they understand the sequence of steps to be taken to operate the system.

Lesson 11 Evaluation

The test items for this lesson block is not included in this document in order to retain confidentiality.

To obtain a copy of the tests, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Final Classroom Training Evaluation

The comprehensive final evaluation should be used to determine if screeners have met classroom performance objective criteria. Although individual lesson evaluations are given after each lesson plan, these evaluations serve as training aids for the screener, to reinforce and emphasize information that is important for adequate operations of the CTX 5000. The final evaluation was developed to support the performance objective criteria (as outlined in Section 1, "Screener Performance Objectives"), and it should therefore be assumed that if the screener passes the final evaluation, then performance objectives have been met (see note for exception). The screener performance objectives are as follows:

1. Understand the purpose, function, and operation of the CTX 5000.
2. Understand their roles, duties, and responsibilities as CTX 5000 operators in the airport demonstration.
3. Gain basic knowledge and comprehension of military, commercial, and improvised explosives, including improvised explosive device (IED) components and configurations.
4. Be able to identify and recognize explosives, IED components, non-explosive threats, and common and frequently seen objects on both the CT and X-ray screens.
5. Develop proficient decision-making skills in determining the level of threat-uncertainty that requires either further inspection of CT or X-ray images, a physical search of the bag, or notification of the CTX supervisor or security law enforcement officer (LEO).
6. Know and understand the appropriate procedures to take when confronted with a potential threat.
7. Develop the necessary skills to proficiently, independently, and confidently operate the CTX 5000, utilizing all threat resolution tools.

NOTE: The only performance objective that screeners are not required to have completed at this point in the training session is number 7 above. Screeners will not be able to proficiently, independently, and confidently operate the CTX 5000 until *after* they have completed the hands-on operations and OJT training. Upon completion of OJT, screeners should have met this final objective.

Final Evaluation

The test items for this lesson block is not included in this document in order to retain confidentiality.

To obtain a copy of the tests, submit a written request citing this document and a justification to:

The Associate Administrator for Civil Aviation Security, ACS-1
U.S. Department of Transportation
FAA Headquarters
800 Independence Ave., S.W.
Washington, D.C. 20591

Section 3: Hands-On Operation

Objective	Familiarize screeners with hands-on CTX 5000 operations.
Lesson Time	1-1/2 days
Training Materials & Equipment	<ol style="list-style-type: none">1. CTX 5000 system2. Packed baggage containing IEDs from MBS3. List of MBS combinations and simulants (96 possible)

Content

After completing lesson 11, screeners should be somewhat familiar with operating the system. In this section, screeners will now be operating the system.

Screeners will be instructed to use a systematic approach and encouraged to utilize controls and functions for all tasks, subtasks, actions, and outcomes that they may encounter while operating the CTX 5000. Screeners should follow the written procedures for all phases of operation (from start-up to threat resolution) and physically perform these tasks, while verbally describing what they are doing. This allows both the screeners to think about what they are doing and the instructor to understand the thought processes of the screeners. If screeners are having problems following the procedures, the instructor should give verbal prompts to aid the screener.

Upon completing this lesson, it is expected that screeners will *not* be completely proficient in using the CTX 5000; however, this section ensures that screeners have acquired and are correctly implementing classroom knowledge while operating the CTX 5000 system.

The following procedures are also found in the CTX 5000 Operational Procedures. Rules and concepts have been inserted to aid screeners.

You will be instructed to use the following procedures during training [sequence we use is completely arbitrary]. Once you are more familiar with the system, you may use whatever sequence or strategy that works best for you.

NOTE: Instructors should make sure that screeners follow procedures exactly to ensure that each step has been completed. To help guide screeners through the operational procedure, either a copy of this lesson plan, or a separate procedures support sheet containing the operational procedures, should be provided to screeners.

Content

1. Read and discuss the lesson objective.

NOTE: You will be instructed to use the following procedures during training [sequence demonstrated is completely arbitrary]; however, once you are more familiar with the system, you may use whatever sequence or strategy that works best for you. Instructors should make sure that screeners follow procedures exactly to ensure that each step has been completed. To help guide screeners through the operational procedure, a support sheet containing the operational procedures will be provided to screeners during hands-on operations, as well as at the airport CTX 5000 site (in a secure location and easily accessible to screeners).

2. Power Up.

- a) Turn system on (turn to RUN position on switch).
 - b) The X-ray and CT monitors appear and the lights on the console panel turn on.
3. Press RESTART SOFTWARE soft key on computer monitor (under the Fault Menu). In 3 minutes, the scanner will initialize itself and conveyors will become active automatically.
4. The default scanning mode is NEVER HOLD ON and HOLD ON ALARM. In the default mode, *cleared bags* are unloaded and sent on to the airport conveyor without operator intervention. Validate that baggage loading mode is correct mode. Both the NEVER HOLD and the HOLD ON ALARM hard keys should be lit.

5. Baggage loading.

- a) Place bag on conveyor belt.
 - b) Use hand unit (press INSERT key).
 - c) Is bag oversized? [Oversized bags are automatically detected. The box or bag will stop on the infeed conveyor. All bags in line stop.] Position the oversized bag for its entry, or remove it. Then press the READY button on hand set. Continue on with the following steps below.
 - If no, continue on.
 - If yes, position the oversized bag for its entry, or remove it. Then press the READY button on hand set. Continue on.
 - d) Does bag jam at the infeed?
 - If no, continue on.
 - If yes, press the E-STOP button on the wall. Correct the jam. Pull out the E-STOP button on the wall. If the yellow button light on the infeed conveyor is on, press it. Continue on.
6. **Indicator Lights on Ceiling.** Screeners should pay attention to the indicator lights on the ceiling and know what each of the colored lights represent.

- a) Blue Light means that the bag sitting on the outfeed conveyor is waiting for an operator decision.
- b) Green light means that the bag sitting on the outfeed conveyor is clear and will be automatically sent onto the airport's exit conveyor.
- c) Red light means that the operator has pressed the SUSPECT button. After inspecting or removing the bag always press the green outfeed conveyor button to resume screening after a suspect bag.
- d) Flashing red light means the system has a fault or is recovering from a fault. There may or may not be a bag on the outfeed. If the system does not correct this problem automatically, press the green outfeed conveyor as many times as needed (if bags are still going to the outfeed) until the red light stops flashing. Press the green outfeed button 4-5 times, or more if need be.
- e) Flashing red light may also mean that a bag has been removed or the system has to clear/reset the outfeed conveyor and the green outfeed conveyor button was not pressed. Unless the airport's conveyor is stopped, press this button as many times as needed until the red lights stops flashing.

7. Machine Alarm?

- a) Is red alarm light blinking on the console panel?
- b) Is there an auditory warning signal?
 - If no, CLEAR bag and load or view new bag.
 - If yes, continue on with the following steps below.

8. Threat Resolution Tools.

- a) Do you recognize the object?
 - If yes, either press CLEAR key to clear bag or press SUSPECT key to hold bag for further inspection.
 - If no, continue using as many threat resolution keys as necessary, on both the CT and X-ray screens, until the potential threat object is recognized. Continue on with the following steps below.

9. CT Screen.

- a) Look at explosive type to aid in locating and identifying object.
- b) Look at threats to determine how many potential threats you need to examine.
- c) Look for object with a *red box* around it. This is *current* threat if there are multiple threats.
- d) Use threat resolution tool keys:
ZOOM. Try both ways of zooming.

- Click on object using trackball. Click again to get out of zoom mode.
- Hold down ZOOM key on console panel. Release ZOOM key to return to normal size.

Click on COLOR THREAT soft key. Click again to get out of COLOR THREAT mode.

Click on COLOR RANGE soft key. Click again to get out of COLOR RANGE mode.

Click on COLOR DETON soft key. Click again to get out of COLOR DETON mode.

Click on COLOR METAL soft key. Click again to get out of COLOR METAL mode.

Click on INVERT IMAGE soft key. Click again to get out of INVERT IMAGE mode.

- e) Look for green object. This is a possible detonator. Is it near or in the red area?
- f) There are three ways to select CT slices to be selected as a large CT image. The CT slices are the CT images on the CT screen and are located in the six smaller images, around the large CT image.

Put the cursor on a small CT image and click.

Press the PREVIOUS SLICE or NEXT SLICE hard keys on the console panel. Pressing PREVIOUS SLICE displays the CT slice to the left of the current large CT image. Pressing NEXT SLICE displays the slice to the right of the current large CT image.

Place the cursor on the small blue CT line at the top of the X-ray screen and click.

- g) If at this point, you still cannot resolve the alarm, you may need to view more slices. The MORE SLICES function is located on the console panel and is used to acquire more CT slices anywhere in the bag. These CT slices are acquired at 1 cm intervals.
- h) Look for object which is *highlighted* in red. This is *other* threat.

Press NEXT THREAT key.

Click on other threat (highlighted in red).

10. X-ray Screen.

- a) Look for object with a *red box* around it. This is *current* threat if there are multiple threats.
- b) Use threat resolution tools:

ZOOM. Try both ways of zooming.

- Click on object using trackball. Click again to get out of zoom mode.

- Hold down ZOOM key on console panel. Release ZOOM key to return to normal size.

Point cursor to vertical contrast scale boxes to change contrast. There are two ways to use the contrast scale. The image can be changed by pointing a clicking on the desired box, or by clicking down and keeping finger on the click, you can move up and down the scale to the desired contrast level.

Click on SHARP X-RAY soft key (located on CT screen). Click again to get out of SHARP X-RAY.

Click on HI-POWER X-RAY soft key (located on CT screen). Click again to get out of HI-POWER X-RAY.

- c) Look at threats again to determine how many *other* threats need to be examined. Then look for object with a *yellow* box around it. This is *other* threat.

Press NEXT THREAT key.

Click on other threat (highlighted in red).

Continue looking at *each* threat in the bag until all threats have been resolved.

11. Threat Resolution.

- a) After having completely examined all potential threat objects, using all threat resolution tools, does the object have many characteristics to be a real threat?
 - If no, press CLEAR key to clear bag and continue on to next bag.
 - If yes, press SUSPECT key to hold bag for further inspection and immediately call a supervisor.

12. Daily Shut Down.

- a) Turn the key switch on the console panel to OFF position and remove the key and return it to its storage location to ensure against unauthorized use.
- b) The X-ray and CT monitors turn off and the lights on the console panel turn off.

13. Fault Recovery.

- a) A fault can be caused by a variety of reasons, such as a bag jam or a software error. Faults are indicated by a *fault dialog box* on the X-ray screen.
- b) To recover from a fault, first click the fault dialog box's ACKNOWLEDGE soft key.
- c) Take the required steps to correct the problem, such as removing a jammed bag.
- d) Click on the FAULT RESET soft key on the fault menu. WAIT 30 SECONDS for operations to resume (the soft key's dot stops flashing).

WARNING: DO NOT PRESS THE FAULT RESET KEY BEFORE THE DOT HAS STOPPED FLASHING!

- e) During FAULT RESET, a DIEBACK may occur, displayed as a *fault dieback* on the X-ray screen. Press the GREEN OUTFEED CONVEYOR button to remove the dieback.
- f) If the fault is not corrected by clicking FAULT RESET, click on the RESTART SFTWARE (restart software) soft key on the fault menu. A dialog box will appear on the X-ray screen confirming if software is to be restarted. Click on YES. Wait patiently for 3 minutes to resume screening operations after the X-ray and CT screens reappear and the scanner is ON.

14. Q&A period.

Completion Standards

The lesson will have been successfully completed when, as shown by demonstration on the system, screeners know how to start up the system, use the emergency stop button, the hand unit and load baggage, all hard and soft keys, threat resolution keys, and read display information.

Classroom Training Performance Evaluation

Performance evaluations will be conducted after the hands-on operation is completed to determine screeners' proficiency on the CTX 5000 system. The performance evaluation will consist of each screener examining twenty test bags for threat objects. Because this evaluation consists of quantitative measurements of hits and false alarm rates, the instructor should *not* be concerned with procedural strategies and operational skills of the screener. Rather the instructor is concerned with screeners' abilities to *detect* threat objects with minimal false alarms.

The test bags used in this evaluation will contain IEDs from the MBS and explosive simulants. The same combinations given in lesson 8 will be given. Test bags for the performance evaluation will include the following:

- Ten bags containing *no* threats (with common objects) .
- Ten bags containing IEDs (with common objects).

The instructor will observe and record the number of hits (P_d) and false alarms (P_{fa}) for each screener.

Completion Standards

The lesson will have been successfully completed when, as shown by performance evaluation testing, screeners score at least 90% on threat detection.

Section 4: Screener Performance Evaluation Procedures

Objective	Determine if screener performance is within acceptable limits, based on regularly conducted evaluations [frequency of evaluations to be determined].
Lesson Time	To be determined
Training Materials & Equipment	CTX 5000 system Packed baggage containing IEDs from MBS and explosive simulants List of MBS combinations and simulants (96 possible)

Content

Performance evaluations should be conducted on an ongoing basis by both the airlines and the security company, in order to determine long-term learning and overall effectiveness of the training program. The design of the evaluation (number of bags) and acceptable scores will also be determined. The objective evaluations and measures include, but are not limited to, the following data:

- Number of hits (P_d)
- Number of false alarms (P_{fa})
- Others to be determined (e.g. measures of signal detection sensitivity)

Completion Standards

The lesson will have been successfully completed when, as shown by performance testing, screeners' scores meet the acceptable standard requirements for ongoing explosive detection.

Section 5: On-the-Job Training

Objective	Familiarize screeners with operational procedures of the CTX 5000 and develop screener proficiency in the areas of viewing, identifying, and resolving display images.
Lesson Time	Approximately three 8-hour shifts (equivalent of 24 hours) per individual or until CTX supervisor signs off on them.
Training Materials & Equipment	<ol style="list-style-type: none">1. CTX 5000 system2. Packed baggage containing IEDs from MBS and explosive simulants3. List of MBS combinations and simulants (96 possible)

Content

1. Read and discuss the lesson objective prior to initial on-the-job training (OJT).
2. OJT refers to the training that is conducted with real passengers and baggage. The OJT operational procedures should be similar to the hands-on operations performed during training. Screeners will be pressured for time but should try to follow the rules and concepts for identifying threats, as learned in classroom and hands-on operational training.
3. CTX supervisors should guide screeners on task procedures and encourage them to use threat resolution tools.
4. CTX supervisors should encourage screeners to ask questions or consult the Users Manual if they do not understand something.
5. CTX supervisors, during the airport demonstration project, should encourage screeners to give feedback on any issues concerning the CTX 5000, including tasks, procedures, and responsibilities.
6. The trainer should encourage screeners to continuously ask questions or make comments throughout the OJT sessions.

Completion Standards

The OJT will have been successfully completed when the CTX supervisor certifies the screener to independently operate the CTX 5000.
